LIVESTOCK ENTERPRISES

EDITED BY

KARY C. DAVIS, Ph.D.

Dean Mc Donald

FARM ENTERPRISE SERIES
EDITED BY KARY C. DAVIS, PH.D.

DEDICATED TO
THE FUTURE FARMERS OF AMERICA AND ALL PROGRESSIVE STUDENTS OF AGRICULTURE, WITH THE HOPE THAT THIS SERIES WILL OPEN THE WAY AND INSPIRE THEM TO PURSUE FARMING ENTERPRISES BY THE MOST RECENT AND APPROVED PRACTICES.

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FARM ENTERPRISE SERIES

Edited by Kary C. Davis, Ph.D.

SOUTHERN FIELD-CROP ENTERPRISES, by several specialists

FIELD-CROP ENTERPRISES, by several specialists

LIVESTOCK ENTERPRISES, by several specialists

HORTICULTURE ENTERPRISES, by K. C. Davis and several specialists

DAIRY ENTERPRISES, by J. C. McDowell and A. M. Field

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LIVESTOCK ENTERPRISES

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PREFACE

"Livestock Enterprises" is a new book on a new plan with a great deal of new subject matter based upon the latest experiment-station findings in all of the livestock classes of the farm.

The job-analysis plan of organizing the subject matter has been followed. This practical plan is rather uniform in all of the seven enterprises treated.

Each enterprise is first analyzed into its logical farm jobs to be used as teaching units. In all enterprises these include not only production jobs but also business and marketing jobs.

Problems and aims are given under all of the many jobs. Conditions which usually confront the class in attacking each job are stated in very general terms.

Local inquiry questions are always included in each list of "problems for study and discussion." These insure that all jobs will be based on the best farming practices of the region. Suitable activities are suggested for each job. These will aid in "carrying home" the class discussions.

Job-analysis plans of organizing subject matter have apparently found a permanent place in the departments of vocational agriculture in America.

The best teachers of agriculture have made thorough and extensive trials of this method of approach and consider it better than the old unsystematic, time-consuming, haphazard plans, in which comparatively few of the jobs of the enterprise were ever thoroughly tried by the class. A group of teachers who believe in job analysis have suggested the following reasons for organizing subject matter according to this valuable plan.

Saves time of the teacher.
Allows teacher to use his time to better advantage.
Saves time of student in preparing assignments.
Systematizes the instruction.
Follows a more logical sequence.
Arouses and holds interest of students.
Forms a basis for more connected knowledge.
Secures better aims in recitations.
Students remember teachings better.
Knowledge is more easily applied by students.

Important points are less likely to be omitted.
Students can plan their work better.
Correlation with other subjects is easier.
Class work harmonizes better with student's projects.
School work harmonizes with the enterprises of the community.
Farming of neighborhood is used to better advantage.
Parents and neighbors are involved in the studies being made.
Class work is planned according to seasonal sequence.
Community is enlisted in support of school work.
Assignments are more specific.
Assignments by pages are eliminated.
Use of reference material is more definite.
Students accomplish more in study period.
Visitors can grasp class discussions better.
Topical method is more easily followed.
Field trips by group have better aims.
Field trips are often less necessary.
Tendency to lecture to class is avoided.
The mind of the student is more completely directed to farming.
The step to complete placement in farming is easier.

Dean Mumford has said, "Agriculture is a permanent industry. No change in government, no social upheaval, no revolution can destroy the land or the industry upon which human life depends for food and clothing. The establishment of an independent home is a dream that is in the soul of every man. In some men it is a passion. The successful farmer of the future will be the man who has equipped himself with knowledge."

Authors and Other Specialists

The Authors.—Each of the seven enterprises in this book is written by either a specialist in subject matter or a specialist in vocational agriculture. These authors have the teacher's point of view more clearly in mind than any group that could possibly be assembled for these enterprises from other types of work. They know the teacher's needs and have tried to meet these needs. They know the importance of teaching according to enterprise units. They believe in job analysis as a helpful method of organizing the subject matter. They believe in maintaining a close connection between class-room work and farm jobs. They believe in tying up closely the experiences of farmers with the studies of future farmers. To accomplish these purposes, they have outlined and written these enterprises.

Specialists and Subject-matter Experts.—The manuscripts of the different enterprises have been submitted to authorities for criticisms, suggestions, and revisions. The work of these specialists and subject-matter experts has assisted the authors in making their sections authoritative, reliable, and completely up-to-date. The most recent findings of experiment-station trials have been included where space allows, and the latest teachings of the experiment stations have been the basis of subject matter in all the enterprises. Credit for illustrations not supplied by the author of the enterprise is given in each case.

Dairy Enterprise.—Author, Herbert Perry Davis, B.S., M.S., Lincoln, Neb., Professor of Dairy Husbandry, University of Nebraska. Read and criticised by James H. Pearson, State Supervisor of Agriculture, Neb.; H. E. Bradford, Professor Agricultural Education, University of Nebraska.

Beef Enterprise.—Author, Louis Wermelskirchen, B.S., M.S., Farmington, Ia.; Teacher of Vocational Agriculture, Formerly State Supervisor of Vocational Agricultural Education. Read and criticised by Carl N. Kennedy, Assistant Secretary of Agriculture of Iowa.

Horse and Mule Enterprise.—Author, Sherman Dickinson, B.S., M.S., Ph.D., Columbia, Mo., Professor of Agricultural Education University of Missouri. Read and criticised by E. A. Trowbridge, Professor of Animal Husbandry, University of Missouri. F. J. Hubbard, Director Vocational Agriculture, Jackson, Miss.

Swine Enterprise.—Author, William Herschel Smith, B.S., M.S., Urbana, Ill., Professor and Associate Chief in Animal Husbandry Extension, University of Illinois.

Sheep Enterprise.—Author, Walter Costella Coffey, B.S., M.S., Ph.D., St. Paul, Minn., Dean Dept., of Agriculture, University of Minnesota.

Poultry Enterprise.—Author, Herschel Ward Nisonger, B.S., M.A., Columbus, O., Professor of Agricultural Education, Ohio State University. Read and criticised by Prof. A. R. Winter, Ohio Agricultural Experiment Station, Wooster.

Bee Enterprise.—Author, Kary Cadmus Davis, B.S., M.S., Ph.D., Professor Agricultural Education, Knapp School of Country Life, Peabody College, Nashville, Tenn. Read and criticised by Frank C. Pellet, Associate Editor American Bee Journal, Hamilton, Ill.; Mrs. Armstrong Allen, Instructor in Bee Keeping, Peabody College.

CONTENTS

Dairy Enterprise.. 1
Beef Enterprise.. 99
Horse and Mule Enterprise.. 165
Swine Enterprise.. 223
Sheep Enterprise.. 281
Poultry Enterprise.. 351
Bee Enterprise.. 449
Appendix.. 463
Index.. 473

DAIRY ENTERPRISE

By Herbert P. Davis, B.S., M.S.

Professor of Dairy Husbandry, University of Nebraska

Analysis Into Jobs.—The following jobs include the main teaching and managerial points in the teaching of the dairy enterprise. References are to numbers of U. S. Farmers' Bulletins.

1. Determining dairy possibilities. Bul. 1272, 1428.
2. Selecting a dairy breed. Bul. 993, 1066, 1361, 1443.
3. Selecting dairy cattle. Bul. 1066, 1443.
4. Planning pastures and rotations.
5. Caring for calves and young stock. Bul. 949, 1336.
6. Feeding the dairy herd. Bul. 743, 1336, 1382.
7. Caring for and managing the herd. Bul. 949, 1412, 1422.
8. Improving the herd; keeping records. Bul. 1446.
9. Controlling diseases and enemies. Bul. 206, 1069, 1446.
10. Testing for butter-fat.
11. Planning dairy-farm buildings. Bul. 855, 954, 1214, 1342.
12. Showing and selling cattle.
13. Producing and selling milk. Bul. 602, 976, 1359.
14. Making and marketing butter. Bul. 876.
15. Making and marketing cheese. Bul. 960, 1191, 1451.

Job 1. Determining Dairy Possibilities

Conditions Usually Found.—(1) Dairying as a major enterprise is usually found near cities or in districts where land is expensive. (2) A district that once starts dairying has usually reached a permanent type of agriculture. (3) The keeping of a few dairy cows to supply milk, cream and other dairy products for the farm and selling of the surplus is a common and desirable practice.

Aims.—The desirable and undesirable features of dairying as applied to the farms of the community should be learned.

Problems for Study and Discussion.—(1) What is the relation of the dairy industry in the United States to other branches of agriculture?

2. Why can dairying operate on high-priced land?
3. What type of dairy farming is practised locally?
4. To what extent is dairying growing or declining locally and nationally?
5. Compare local prices for different methods of milk disposal.
6. Give reasons for and against the retail distribution of milk.
7. Discuss advantages and disadvantages of dairying.

Activities.—Make a chart showing the comparative prices for wholesale milk, retail milk, cream, cheese, and butter from 100 pounds of whole milk.

Dairy Industry Occupies an Important Place in Agriculture.—Agriculture is the world's largest and most necessary industry and it includes many branches or subdivisions. Among the most important is the dairy industry or dairying. Strictly speaking, the dairy industry includes the breeding and raising of dairy cattle or other milk-producing animals; the handling and processing of milk; and the manufacture of the products made from milk, such as butter, ice cream, the various kinds of cheese, condensed and powdered milk, casein, and milk sugar. So closely related to the dairy industry as to be almost in fact a part of it, are the sanitary inspection services of the federal, state, and municipal governments and private corporations, and the manufacture and sale of apparatus and machinery. Altogether the dairy industry and its related lines are important and vital factors in the life and business of the country.

In the United States, the amount of money invested in the dairy industry places it in first place, or near the top, among the various agricultural industries. The value of various milk products sold yearly amounts to more than two and three-quarter billion dollars. Add to this the value of buildings, equipment, and dairy cattle and the total is stupendous. There are approximately one-fourth of the world's milk cows located in the United States, which is now the greatest dairy country in the world.

Stability of Dairying.—Any enterprise that lacks a permanent demand for its products, or is only seasonal in character, lacks stability. The market for milk and its products is constant and is little affected by seasons. Price fluctuations are therefore smaller than for other agricultural products. This insures a steady income throughout the year and from year to year, impossible in many other enterprises. Dairying is one of the most permanent of agricultural enterprises because the keeping of livestock and the sale of their products does not reduce the fertility of the land. The manure from dairy cattle maintains and actually enriches land so that dairy farms properly managed maintain, year after year, and usually improve in crop yields. Holland is a typical example of a country where dairying has been conducted for centuries, yet the crop yields are better than in days gone by.

Dairy products are largely appreciated because of their high food value, ease of digestion and vitamin content. Since the rôle of vitamins in maintaining health has been understood, the vital importance of milk and its products to public health has been appreciated. Children must have plenty of milk to grow normally, have good teeth, and develop strong bodies. Adults may prevent much illness and even cure some disorders by the proper use of milk.

Animals are efficient machines for the conversion into human food of coarse, rough feeds unfit for human use. The common farm animals are compared as to their efficiency in the following table:

Relation of Feed to Product

	Produced by 100 lbs. Digestible Organic Matter in Ration	
	Marketable Product Lbs.	Edible Solids Lbs.
Cow producing milk	139.00	18.00
Beef steers, carcass	8.30	2.75
Sheep and lambs, carcass	7.00	2.60
Swine (hogs), carcass	25.00	15.60
Calves, carcass	36.50	8.10
Fowl, carcass	15.60	4.20
Fowl, producing eggs	19.60	5.10

The dairy cow produces 18 lbs. of edible solids from 100 lbs. of digestible feed, and can do it year after year.

Types of Dairy Farming.—Dairy farming may be divided into two general types: where it is the major enterprise and where it is a minor one. A major enterprise is one from which at least fifty per cent of the income is obtained or is the largest of several, in which case it may not bring in half the income. A dairy community is usually a prosperous one.

As a major enterprise dairying is not suited to all parts of the country. To be successful, dairying must have a good market readily available for all the milk or cream at satisfactory prices, cheap and efficient transportation between farm and market, an abundance of feed suitable for feeding dairy cattle, proper buildings and equipment, high-producing dairy cows, and plenty of labor at reasonable wages.

Dairying as a minor farm enterprise is suited to the great majority of the farms of the country. A few cows to supply the family with milk and cream and possibly butter and cheese are needed on practically every farm. The addition of a few more cows will allow the production of extra milk and cream which can be sold. These may be some of the dual-purpose type (Figs. 1 and 2). The total receipts from the dairy may be small and yet add materially to the total farm income.

Methods of Milk Disposal.—Milk may be sold, made into cheese, or separated and sold as cream; or cream may be churned and the resulting butter sold. The most profitable means depends upon the local conditions, market demands, and the equipment, time, and labor needed.

When milk is sold in the form of whole milk, the equipment needed depends upon how it is ultimately used. When milk is sold for direct human consumption it is essential to have a good barn with solid floor and plenty of light; a clean milk house or room for handling milk; a cooler; and a boiler to provide hot water for washing utensils and steam for sterilizing. Milk is a human food that may easily become contaminated by dirt or odors and may thus be changed from a clean healthful food to a possible menace to health. Cleanliness is absolutely essential in the production of healthful milk and refrigeration or cold is the best method of keeping good milk in excellent condition. A horse-drawn wagon should be provided for delivering the milk if it is sold retail. Wholesale disposal of milk necessitates less equipment and less labor. The sale of cream requires a separator and leaves the skim-milk on the farm for feeding. Farm butter making and farm cheese making are not likely to be as profitable under ordinary conditions as other methods of selling.

Relative Profits from Different Ways of Selling Milk.—It must be understood that the relative prices received for milk or cream or butter vary from season to season, year to year, and locality to locality. Usually the highest price is received for milk sold at retail and delivered to the customer, because the greatest service is rendered. Selling milk wholesale, either to a milk distributor who in turn distributes it to the consumer or to a condensery, milk-powder plant, or cheese factory, shows less gross returns.

Selling sweet cream is usually more profitable than selling sour cream and may be as profitable as selling milk. In the last two instances the skim-milk is left on the farm and may be used for feeding purposes, its value should therefore be considered.

Disadvantages of Dairying.—To milk and to take care of cows is a daily task that cannot be slighted on Sundays and holidays. Good barns and equipment are needed for the proper production and care of milk.

Job 2. Selecting a Dairy Breed

Conditions Usually Found.—(1) Dairying is too often carried on with any breed of cows regardless of their suitability for the purpose. (2) Many beef and dual-purpose types cannot compete efficiently with the dairy breeds.

Aims.—Students should know the factors to be considered in choosing a breed of cattle for dairy purposes. The characteristics of the several breeds should be understood.

Problems for Study and Discussion.—(1) Why choose a dairy breed in preference to a beef or dual-purpose breed for producing milk?

2. Which type is most popular locally? Why?
3. Discuss considerations in choosing a dairy breed for local farms and markets. Give reasons for selection.
4. Compare dairy and dual-purpose breeds as to milk production, percentage of butter-fat, and butter-fat production.
5. Name and give important characteristics of each dairy breed.
6. Name and give characteristics of your most popular dual-purpose breeds.
7. What has the native home of each breed had to do with breed characteristics?
8. Does your home market pay more for higher butter-fat milk? How is this governed?
9. Determine the number of cattle of each breed locally.
10. Determine to what extent any one breed is becoming more popular than the others, and why.

Activities.—(1) Collect good pictures of the dairy and dual-purpose breeds. Mount these on placards for use on the wall of the school room or at home. (2) Make a chart or placard of the four leading dairy breeds with the outstanding advantage and purpose of each. (3) Make a wall chart of the breeds with the average milk and fat production of each.

Why Use a Breed of Dairy Cattle.—All cows of whatever ancestry produce some milk, but under present conditions milk cannot profitably be produced by cows that do not yield large quantities. The range in milk production is from as little as 1000 pounds to as much as 37,000 pounds in a year. Manifestly it is more economical to produce milk with cows capable of large production. Such cows have been developed through a long period of time by careful selection and breeding and have certain characteristics and an inherited ability to produce large quantities of milk and to transmit these qualities to their offspring. In different localities men have had different ideals of size, color, conformation, and richness of milk, and different breeds of dairy cattle have been developed to meet them. Likewise, there were developed breeds of beef cattle having special adaptation to the production of the finest cuts of meat.

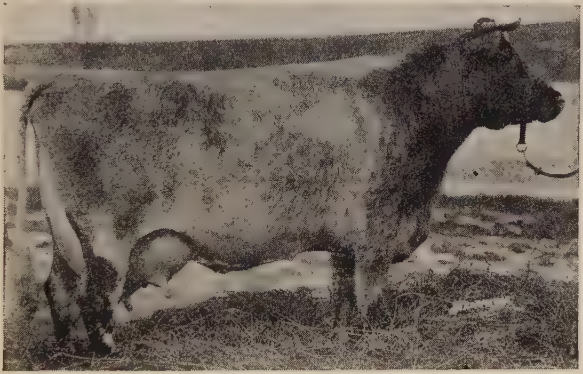


Fig. 1.—Bare Fashion—milking Shorthorn cow. Owner H. E. Tener, New York. Yearly record: 17,000 pounds milk, 581 fat. Compare with Shorthorn figures in Beef Job 2. (Am. Shorthorn Breeders' Assn.)

Midway between are several breeds that do not have either dairy or beef qualities developed to the highest degree, but have some of the qualities of both. Such breeds are called dual-purpose (Figs. 1, 2 and 3). As a matter of fact, beef production, or the laying-on of fat, and milk production are opposite functions and are seldom desirably combined. Not only that, but a dual-purpose animal usually does not breed true to type. The offspring may be beef or dairy in characteristic or sometimes neither.

How to Choose a Breed of Cattle for Dairy Purposes.—The market requirements for the product are important considerations in the selection of a dairy breed. Almost all towns and cities and dairy manufacturing plants have definite requirements for butter-fat and total solids in milk. After these have been met, the breed that will produce the largest flow is likely to be most satisfactory. Probably 3.5 per cent represents the average standard basis upon which milk is purchased, and milk testing less is penalized while higher-testing milk brings more money. As a rule, consumers prefer a rich milk of deep yellow color and in many instances are willing to pay a premium for it. The depth to which the cream extends in a milk bottle, called the cream line, is a common but inaccurate gauge of the quality of milk, and is unfair to a breed that produces butter-fat in very small fat globules. Small fat globules do not readily rise to the top and milk that has most of its fat in smaller globules has little or no cream line. Condenseries and cheese factories prefer medium-testing (4%) milk as giving the best results in manufacture.

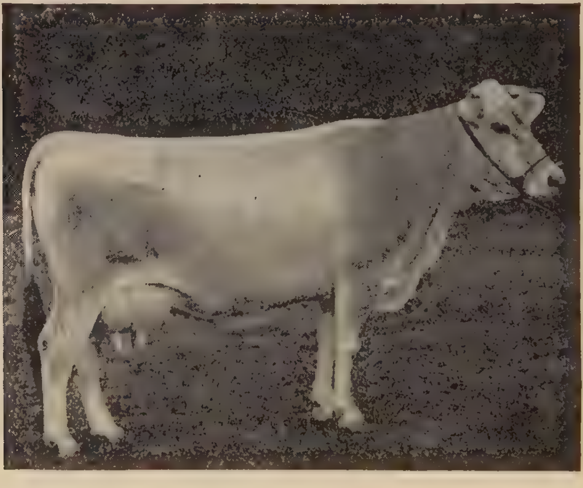


FIG. 2.—Brown Swiss cow, Cinnamon's Maiden. (Brown Swiss Cattle Breeders' Assn.)

The advantages of local coöperation, possible when one breed of cattle prevails in a community, are many. A market is created for surplus animals and for buying replacements for the herd. Large buyers are attracted to localities where they can buy conveniently. Bulls can be exchanged and used coöperatively, which insures satisfactory bull service at a minimum cost.

Personal preference is important, but if it alone is considered, a breed might be selected that would be unsuitable for local conditions and thus bring failure. Greater interest is usually taken in any undertaking if it is liked. In choosing a breed, try to like the breed (1) that fits the market, (2) that is the common breed in the community, and (3) that otherwise suits the conditions.

Climate and Surface.—With the wide range of climatic conditions prevailing in the United States and the difference in character of the land, it is desirable that the nature of the country and the climate should be considered in choosing a breed. On rich level pastures all breeds thrive, but on rough hilly land, where pasturage is scant, there is not an equal adaptability. Different qualities of resistance may be needed in the extreme North from those in the almost tropical South.

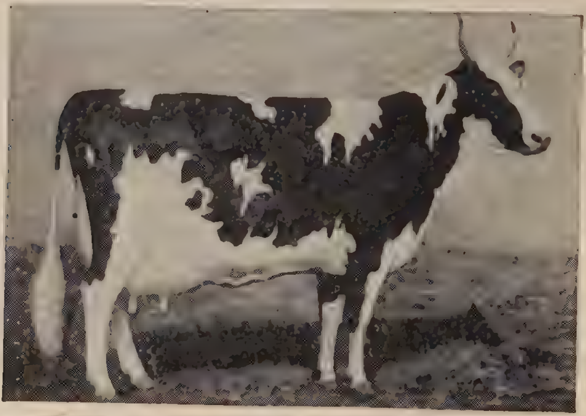
The current price is often an important consideration in choosing a breed. While a breed may be suitable in every other way, if it is too expensive as compared with other breeds, its selection may be inadvisable. Most breeds have had periods of boom with attendant high prices as well as periods when prices were much below real values. A comparison of prices of several breeds for several years will show the situation.

Popularity.—Estimating the future of a breed is difficult. The popularity of a breed affects much more keenly the breeder of pure-breds than the breeder of grade cows. Any breed affected with fads of color or any other immaterial characteristic is likely to suffer. In general, the trend of public demand is for larger cattle in all breeds, since the large animal has the greater possibilities for feed consumption and consequently for milk production. Large calves usually start easier, and grow more rapidly.

Prepotency, or the ability of an animal to transmit its characteristics in unmistakable form to its offspring, is important, especially in choosing a pure-bred sire to use on a herd of common or grade cows. If the calves from such matings show the external characteristics of the sire, it may reasonably be expected that they will show some of the milk-producing characteristics of his ancestors.

The Ayrshire breed (Figs. 3 and 4) originated in the county of Ayr, a rather rough, rolling, sparsely pastured county in southwestern Scotland. In color, Ayrshire cattle vary from white with medium-red to dark-mahogany spots, to red with white spots. As a rule, there is a black muzzle and a white switch. The trend of popularity in this country is toward the whiter animals. The most picturesque and characteristic feature of the breed is their long horns, that turn outward from the head, then forward and upward. Uniform, closely-attached, square, level udders with long body attachment and even teat placing are common in the breed. A rather closely coupled body, quick, vigorous, alert, rather nervous action, and good grazing ability, especially over rough land, are Ayrshire characteristics. In size mature cows vary from 900 to 1300 pounds, averaging about 1100 pounds. Mature bulls vary from 1500 to 2000 pounds with an average of about 1650 pounds. Ayrshire calves weigh from 40 to 70 pounds at birth.

FIG. 3



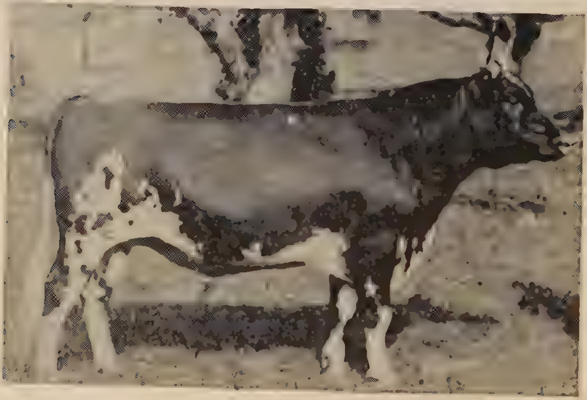


FIG. 4

FIG. 3.—True-type Ayrshire cow. (Ayrshire Breeders' Assn.)
FIG. 4.—Ayrshire bull—Imperial Admiral Beatty of Wendover.

The Milk.—Ayrshire cows produce milk of about the average richness of all dairy breeds. It has its fat in very small globules. The first 6368 pure-bred cows and heifers completing official records produced an average of 10,359 pounds of milk, containing 412.77 pounds butter-fat, and testing 3.98 per cent of butter-fat.

The Highest Ayrshire Milk and Butter-Fat Producers

Butter-Fat Production

		Lbs.
1.	Lily of Willowmoor 22,269	955
2.	Auchenbrain Brown Kate 4th 27,943	917
3.	Garclaugh May Mischief 27,944	894
4.	Auchenbrain Yellow Kate 3d 36,910	888
5.	Agawam Bess Howie 43,781	876
6.	Harperland Spicy Lass 49,652	866
7.	Jean Armour 3d 32,219	859
8.	Nancy Whitehall 47,810	858
9.	Bloomer's Queen 39,119	856
10.	Victor's Beauty Rose 44,021	840

Milk Production

		Lbs.
1.	Garclaugh May Mischief 27,944	25,329
2.	Mistress Thistle of South Farm 49,819	23,029
3.	Auchenbrain Brown Kate 4th 27,943	23,022
4.	Lily of Willowmoor 22,269	22,596
5.	Garclaugh Spottie 27,950	22,589
6.	Nancy Whitehall 47,810	22,075
7.	Jean Armour 3d 32,219	21,938
8.	Bloomer's Queen 39,119	21,820
9.	Willowmoor May Mischief 34,173	21,161
10.	Auchenbrain Yellow Kate 3d 36,910	21,123

Importations.—Ayrshires were imported into the United States first in 1822 and almost every year since. In 1920 there were 30,509 pure-breds in this country and about 400,000 grades. Ayrshires are distributed quite widely in the United States, but the greater numbers are in the northeastern section.

Guernsey Cattle.—One of the Channel Islands, Guernsey, lying off the southeast coast of England, is the native home of Guernsey cattle. Guernseys are typically orange fawn and white with the fawn predominating, although they may vary from a light fawn to an almost cherry red. Typically the muzzle is buff and the switch of the tail white. The skin is very yellow in color and the horns have an amber hue. In disposition, Guernseys are even of temper and not easily disturbed. Mature cows range from 900 to 1300 pounds and average about 1100 pounds. Mature bulls range from 1200 to 2200 pounds and average 1600 pounds. Calves at birth range from 45 to 85 pounds.

The Milk.—Guernsey cows produce very yellow milk with the fat globules averaging rather large. The first 22,900 cows and heifers completing yearly records in the advanced registry averaged 9,675.3 pounds milk, 483.2 pounds butter-fat, with an average test of 4.99 per cent butter-fat.

The Highest Guernsey Milk and Butter-Fat Producers

Butter-Fat Production

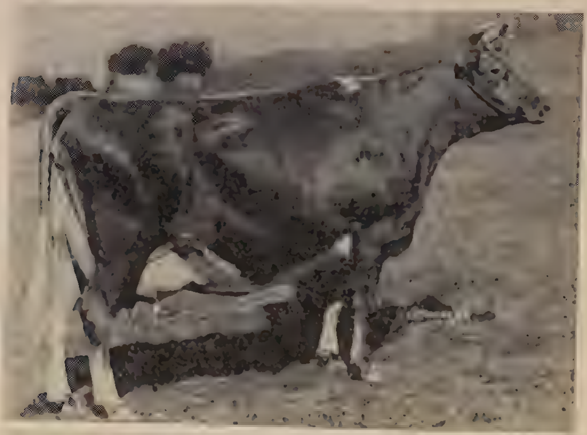
		Lbs.
1.	Anesthesia Faith of Hill Stead 114354	1,112
2.	Countess Prue 43785	1,103
3.	Murne Cowan 19597	1,098
4.	May Rilma 22761	1,073
5.	Gertrude Claire 99550	1,020
6.	Nella Jay 4th 38233	1,019
7.	Langwater Nancy 27943	1,011
8.	Dairy Maid Queen of Spring Hill 74067	1,011
9.	Langwater Hope 27946	1,003
10.	Lillia of Iowa 2d 61500	998

Milk Production

		Lbs.
1.	Murne Cowan 19597	24,008
2.	Katherine's Trixie 100396	21,071
3.	Gertrude Claire 99550	20,738
4.	Nella Jay 4th 38233	20,709
5.	Molly's Lassie 86472	20,591
6.	St. Austell's Daffodil 84890	20,314
7.	Miss Daisy of Maple Hill 72610	20,314
8.	Tom's Daisy 54541	20,297
9.	Silverwood Diana 82940	20,006
10.	Jean DuLuth Coronet 52816	20,004

Importations.—Guernseys were first imported in the United States in 1830 and have been imported almost every year since 1870. At present they are well distributed throughout the United States and the last census shows 79,446 pure-breds and about 1,900,000 grades. The largest numbers are in the North Atlantic and North Central States.

FIG. 5



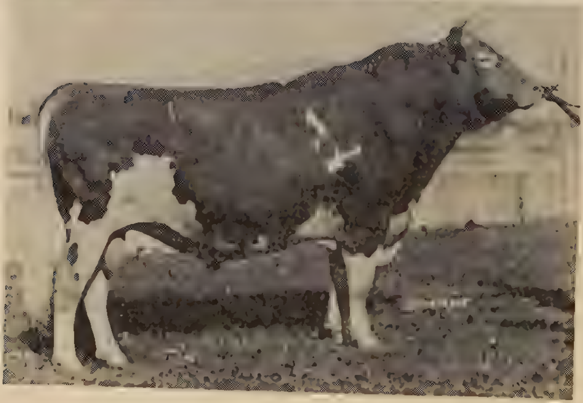


FIG. 6

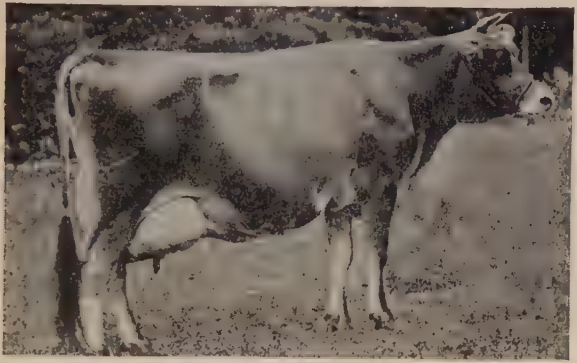
FIG. 5.—Guernsey cow, Jeannette II of the Prairie. (Am. Guernsey Cattle Club.)

FIG. 6.—Guernsey bull May Rose Cherub, grand champion bull 1925, National Dairy Show. (Am. Guernsey Cattle Club.)

Characteristics.—Guernsey cattle (Figs. 5 and 6) have mild, even dispositions and give very yellow milk that is highly esteemed. The calves are none too vigorous and are a little hard to get started.

Jersey cattle (Figs. 7 and 8) originated on the Island of Jersey, the largest of the Channel Islands. The smallest and the most refined of the dairy breeds, the Jersey probably represents the ultimate refinement in a milk-producing animal. Jerseys vary in color from a light shade of fawn through squirrel gray and mouse color to a mahogany brown with occasional white patches. The muzzle and tongue are typically lead color and the switch black. Usually there is a light colored or mealy ring around the muzzle. Mature Jersey cows vary from 750 to 1200 pounds with an average of 900 pounds. Mature bulls weigh from 1200 to 1800 pounds and average 1450 pounds. Calves at birth range from 35 to 70 pounds.

Fig. 7



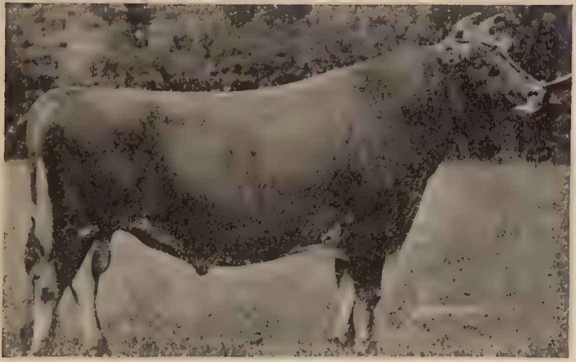


Fig. 8

Fig. 7.—Sociable Sybil, grand champion National Dairy Show, winner of 17 other grand championships. Her yearly record is 15,334 pounds of milk and 855 pounds butter-fat, test 5.55 per cent. (Am. Jersey Cattle Club.)

Fig. 8.—Fern's Wexford Noble, grand champion Jersey bull for three years, National Dairy Show. (Am. Jersey Cattle Club.)

The Milk.—Jerseys produce the richest milk of any of the dairy breeds, and while yellow, it does not quite equal Guernsey milk in that particular. The butter-fat is in large globules, which makes the cream rise readily. The first 30,929 cows and heifers completing Register of Merit records produced an average of 8439 pounds of milk, 447.67 pounds butter-fat, with an average test of 5.36 per cent butter-fat.

The Leading Jersey Producers of Milk and Butter-Fat

Butter-Fat Production		**Milk Production**	
	Lbs.		Lbs.
1. Darling's Jolly Lassie 435948	1,141	1. Madeline of Hillside 389336	20,624
2. Groff's Constance 367292	1,130	2. Fauvic's Star 313018	20,616
3. Prince's Emma of H.S.F. 359390	1,109	3. Abigail of Hillside 457241	20,359
4. Lad's Iota 350672	1,048	4. Fauvic's Ruth 385463	19,805
5. Fauvic's Ruth 385463	1,047	5. Passport 219742	19,695
6. Madeline of Hillside 389336	1,044	6. Sybil's Miss May 477787	19,239
7. Plain Mary 268206	1,040	7. Lad's Likeness 338246	19,223
8. Vive La France 319616	1,039	8. Eminent's Jimp's Owl 297471	19,099
9. Lady's Silken Glow 313311	1,038	9. Raleigh Torono Meme 544207	19,076
10. St. Mawes Lad's Lady 451468	1,032	10. St. Mawes Blossom Rosaire 355800	19,061

Early importations classed Guernseys and Jerseys as Alderneys. About 1850 an importation of Jerseys was made and from about 1870 on, importations have been made almost yearly. Jerseys are the most evenly distributed dairy breed in the United States, there being about 9,300,000 grades and 231,834 pure-breds in 1920 according to the census.

Characteristics.—The Jersey breed is as a rule nervous in disposition, and consequently responds quickly to good or bad treatment. The milk is rich but the milk flow is the smallest of any of the breeds. Jersey calves are small at birth, but grow rapidly. The Jersey seems to be well adapted to a wide range of climatic conditions. For meat purposes, Jerseys and Guernseys are discriminated against because of their yellow fat and poor fleshing qualities.

Holstein-Friesian Cattle.—Dutch cattle, or Friesian cattle, have been bred for centuries in the low countries bordering upon the North Sea and from these cattle the Holstein-Friesians of the United States are descended. The early importations came from the province of Holstein and from North and South Friesland. After several years of contention, the breeders in the United States combined the names to establish harmony. In other countries, this breed is known as Friesian, Dutch Friesian, Dutch or Holland cattle.

This is the largest in size of the dairy breeds. The color may be black and white, each distinct, or combinations with either color predominating, with the preference for legs below the knees and hocks being white. No shade of red is allowed. In its native environment the Holstein was a large consumer of roughage (coarse feeds such as hay, roots, straws, and pasture) and found plenty to eat without effort. As a breed, Holsteins are not especially good rustlers, but are very mild and even in temper and not easily excited. Mature cows range from 1150 to 1800 pounds with an average of 1350 pounds. Mature bulls range from 1600 to 2400 pounds with an average of 2000 pounds. Calves at birth weigh from 70 to 105 pounds.

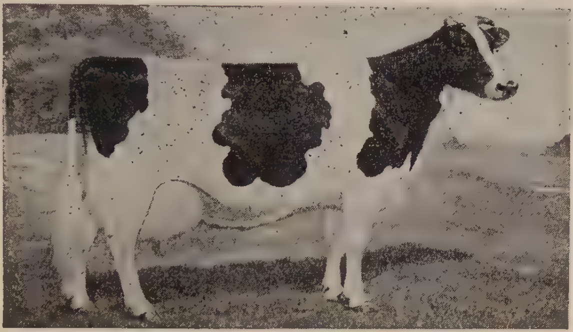


FIG. 9.—True-type Holstein-Friesian cow. (Holstein-Friesian Assoc. of America.)

The Milk.—Holsteins (Figs. 9 and 10) produce the largest quantity of milk on the average and it has the lowest percentage of butter-fat. The milk is rather white in color and the fat globules are small, which it is claimed makes the milk especially suitable for infant feeding. Official records of 25,431 cows averaged 15,720 pounds milk, 532.75 pounds fat, with an average test of 3.39 per cent.

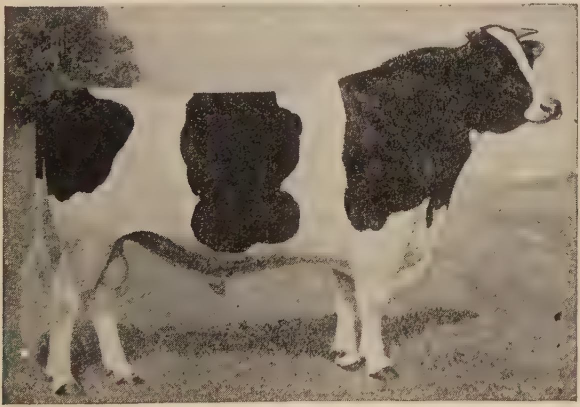


FIG. 10.—True-type Holstein-Friesian bull. (Holstein-Friesian Assoc. of America.)

The Ten Highest Producing Holstein Cows

Butter-Fat Production

		Lbs.
1.	DeKol Plus Segis Dixie 295135	1,349
2.	May Walker Ollie Homestead 300043	1,218
3.	Hollywood Lilith Palmyra Abbekerk 400491	1,206
4.	Duchess Skylark Ormsby 124514	1,205
5.	Bess Johanna Ormsby 263431	1,198
6.	Redfield Segis Johanna 735950	1,182
7.	Finderne Pride Johanna Rue 121083	1,176
8.	Segis Pietertje Prospect 221846	1,158
9.	Dutchland Pietertje Creamelle 394861	1,148
10.	Grahamholm Colantha Pauline Segis 405465	1,141

Milk Production

		Lbs.
1.	Segis Pietertje Prospect 221864	37,381
2.	Helm Veeman Woodcrest 486877	36,217
3.	Kolrain Marion Finderne 317396	35,339
4.	Kolrain Finderne Bess 291570	35,085
5.	Nooksack Lunde Oregon DeKol 301119	34,510
6.	Queen Carlotta DeKol 311674	34,430
7.	Adirondac Wietske Dairy Maid 204072	34,401
8.	Grahamholm Colantha Pauline Segis 405465	34,291
9.	Princess Aaggie Polkadot DeKol 372024	34,070
10.	Grahamholm Colantha Segis Maid 405466	33,811

Importations.—Records indicate that the first importation of Holsteins was in 1795, that in the '80's up to 1887 there were heavy importations, and that from that year until 1905 there were frequent shipments. Since 1905 the importation of any cattle from the Continent of Europe has been largely prohibited because of the prevalence there of foot and mouth disease. The 1920 census showed 528,621 registered Holstein cattle in the United States and more than 10,500,000 grades. The breed is well distributed throughout the United States but the largest numbers are found in the states with or near large city population, since the Holstein is well adapted for market milk. New York, Wisconsin, Pennsylvania, Ohio, Michigan, and Illinois contain about 60 per cent of all the pure-breds of this breed in the United States.

Characteristics.—The Holstein is a large-framed animal and consequently a little more expensive to keep than the smaller breeds. It is strong and vigorous and fattens well, and the fact that the calves are large at birth and grow rapidly is an advantage. Holsteins are not good rustlers, and the low percentage of fat in their milk has been objected to.

Brown Swiss Cattle.—Perhaps the oldest of the dairy breeds, the Brown Swiss have been bred for centuries in the mountains of Switzerland. Brown Swiss vary in color from a light brown to a dark brown, and mouse color and gray are not uncommon. Usually there is a light strip along the back and around the eyes and muzzle. The underpart of the body is usually of lighter shade. Splotches of white on the side or back are objectionable. The nose, tongue, switch and horn tips are usually black. Mild in disposition, the Brown Swiss are very good rustlers but slow to mature, being the slowest of the dairy breeds. When mature, the cows weigh from 1100 to 1600 pounds with an average of about 1250 pounds. Bulls when mature weigh from 1500 to 2200 pounds and average 1750 pounds. Brown Swiss calves are strong at birth and weigh between 65 and 90 pounds.

The Milk production in Brown Swiss cattle may be gauged by their register of production. The first 501 cows and heifers completing records averaged 12,654 pounds milk, 506 pounds fat, with an average test for butter-fat of 4.00 per cent.

The Highest Brown Swiss Producers in Milk and Butter-Fat

Butter-Fat Production	Lbs.	Milk Production	Lbs.
1. June's College Girl 11427	1,062	1. Believe 4245	25,847
2. Believe 4245	1,002	2. Alice Lee 2d 8777	24,844
3. Hawthorn Dairy Maid 6753	927	3. June's College Girl 11427	24,571
4. Alice Lee 2d 8777	914	4. Clothilda Werder's Aggie 10691	22,809
5. Clothilda Werder's Aggie 10691	880	5. Hawthorn Dairy Maid 6753	22,764
6. Goldie Merrillan 12103	873	6. Sterling Pride of Lake View 9530	22,597
7. Darling D 8845	860	7. Goldie Merrillan 12103	22,092
8. Swiss Valley Girl 8th 6574	850	8. Belle Windsor of Tarpleywick 9000	21,211
9. Hawthorn Dairy Maid 2d 8550	850	9. Hawthorn Dairy Maid 2d 8550	21,178
10. Millicent of Walhalla 11178	813	10. Swiss Valley Girl 8th 6574	20,811

The first importation of Brown Swiss cattle into the United States occurred in 1869. There have been later importations; but not in recent years, because of the foot and mouth quarantine against Europe. Brown Swiss are not so widely distributed throughout the United States as some of the other breeds. The largest numbers are found in Illinois, Wisconsin, and New York. The 1920 census showed 8,283 pure-bred Brown Swiss and 162,000 grades.

Characteristics.—The slow maturity of the Brown Swiss is sometimes objected to, as is the lack of uniformity in conformation. The animals are strong, vigorous, good rustlers, gentle in disposition and make good milk cattle.

Dutch Belted Cattle.—These were developed in Holland from the same ancestors as the Holstein. The characteristic markings are black with a white belt, not less than six inches wide, around the middle between the shoulders and the hooks, without black spots in belt. The small numbers of the breed and the necessity of conforming to a particular color pattern has made the selection in the breed for dairy purposes difficult. The breed is similar to the Holstein but a little finer in bone. Mature cows weigh from 1000 to 1500 pounds and average about 1200 pounds. Mature bulls weigh from 1500 to 2000 pounds and average 1700 pounds. At birth the calves weigh between 60 and 90 pounds.

The Milk.—The Dutch Belted owners have not tested as many animals as those of other breeds; but an average of the official records for 63 cows was 9,869 pounds milk, 383.80 pounds fat, average test 3.78 per cent.

The Highest Dutch Belted Producers in Milk and Butter-Fat

Butter-Fat Production	Lbs.	Milk Production	Lbs.
1. Angeline 2641	668	1. Gem of Columbia 2038	17,268
2. Gem of Columbia 2038	633	2. Angelina 2641	16,022
3. Glenbenlah's Beauty 2172	531	3. Ferndell 1961	13,477
4. Priscilla of Lakeview 2937	517	4. Glenbenlah's Beauty 2172	13,295
5. Ferndell 1961	501	5. Peapack Anna 1487	13,159

French Canadian Cattle.—This breed has been developed in eastern Canada from cattle that originally came from the provinces of Brittany and Normandy in France. Having common ancestors, the breed is rather closely related to the Jersey and Guernsey. In Canada, French Canadian cattle have been bred for more than two centuries and have been developed into a vigorous breed accustomed to stand severe weather conditions.

French Canadian cattle are black or black with a light or fawn colored stripe running down the back and a light or mealy ring around the muzzle. They resemble Jerseys very much, and mature cows weigh between 700 and 900 pounds. Good rustlers, the breed is active and well suited to rough hilly pasture land. The milk tests between 4 and 5 per cent.

The largest numbers are found in the province of Quebec, Canada, although there are limited numbers in the New England States and New York.

Red Polled.—These cattle originated in the counties of Norfolk and Suffolk in England. The polled characteristic (absence of horns) was probably introduced by the use of Galloway bulls. Early importations probably were made to the eastern states but the improved type first was introduced into the United States in 1873.

Characteristics.—The breed is of a deep cherry-red color with white markings permitted on the udder, belly, and tip of tail; is without horns; and has light muzzle. Mature cows range in size from 1150 to 1350 pounds and average 1200 pounds. Bulls range from 1800 to 2200 pounds and average 1950 pounds. The Red Polled breed is dual-purpose in its functions, the efforts of the breeders being directed toward developing a breed of cattle that produces profitably at the pail and slaughters well for beef. The breed tends to be irregular in type, some animals being beefy and others of dairy conformation, and the udders, though of good quality, are often pendulous. The animals fatten rapidly when dry.

The Milk.—The average of 505 cows in the advanced register is 9,019 pounds milk, 388 pounds fat with an average test of 4.44 per cent.

The Leading Red Polled Cows for Milk and Butter-Fat Production

Butter-Fat Production	Lbs.	Milk Production	Lbs.
1. Jean DuLuth Beauty 31725	891	1. Jean DuLuth Beauty 31725	20,280
2. Jean DuLuth Pear 28991	707	2. Jean DuLuth Pear 28991	16,598
3. Golden Plutie 47408	677	3. Flossie 26749	14,811
4. Unity Foxy 53916	655	4. Jean DuLuth Latona 34863	13,647
5. Julia 39838	645	5. Julia 39838	13,490

Dairy Shorthorn Cattle.—The Shorthorn breed originated in England, and probably many types of cattle went into its formation. Early in its history different breeders tended to develop different ideals in their breeding. One group emphasized milk production or a combination of milk and beef while the other group tried to develop a strictly beef animal. The result has been that within the breed there is a wide variation in type and ideals. The Scotch type of Shorthorn in America are of strictly beef conformation, while the Dairy Shorthorns are of so-called dual-purpose milk-and-beef type.

The Dairy Shorthorn mature cows average about 1300 pounds, while mature bulls average about 2000 pounds. The color of the breed may be a deep cherry red, white, or roan. The cows are quiet and gentle in disposition and tend to fatten rapidly when dry.

The Milk Production.—2,294 cows in the record of merit average 8,468.6 pounds milk, 337.4 pounds fat, average test 3.93 per cent. The Shorthorn cow tends to lack persistency in milk production and, unless carefully selected, tends also to transmit milk production irregularly. Shorthorns fatten readily and make good beef.

The Leading Shorthorn Producers

Butter-Fat Production	Lbs.	Milk Production	Lbs.
1. Ruth B. 568209	956	1. Ruth B. 568209	21,641
2. Mollie 985118	711	2. Dairy Maid 575122	19,066
3. Snowdrop 647217	692	3. Illington Beauty 1070790	18,257
4. Flintstone Katherine 486414	682	4. Rose of Glenside v57–745	18,075
5. Illington Beauty 1070790	677	5. Butter Girl 655609	17,808
6. Dairymaid 575122	669	6. Rose of Blackwood 3d 36493	17,564
7. Buttercup 2d 179438	657	7. Princess May 2d 648801	17,250
8. Princess May 2d 648801	656	8. Doris Clay 41118	17,241
9. Doris Clay 41118	653	9. Bare Fashion 634770	17,027
10. Alice Crawford 535061	640	10. Flintstone Katherine 486414	16,983

Job 3. Selecting Dairy Cattle

Conditions Usually Found.—(1) Frequently little attention is given to selecting cows for milk production. (2) Too little use is made of the external characteristics that indicate the ability to produce milk. (3) The ordinary cows in a district are usually scrubs or grades and improvement will largely come from improved selection and better sires.

Aims.—(1) Students should become familiar with dairy type and its relationship to production. (2) They should learn to value dairy cattle on dairy qualities.

Problems for Study and Discussion.—(1) Ask local dairymen what points they consider most when choosing dairy cows.

2. What is dairy type?
3. Why are pure-bred dairy cattle likely to be better milk producers than common cows?
4. Why should not a grade bull be used?
5. Why should age be considered in buying cows?
6. In what respects would some breeds be more valuable than others?
7. What is a pedigree, and why is it useful?
8. Practise locating the points of a dairy cow.
9. Select good cows and bulls, using score cards.
10. Compare cows in local herds as to points of superiority.

Activities.—(1) Practise judging dairy cows and bulls, using the score method. (2) Compare dairy calves of similar age and place them as in a show ring, giving reasons. Do this also for other rings of dairy animals.

Dairy Type.—In the development of cattle, selection has aimed at three goals, namely: milk; beef; draft or hauling. In America only the first two are important. Beef type may be described as square, blocky, close to the ground, with heavy fleshing over all parts. Viewed from the side such an animal looks like a rectangle.

Dairy type differs in that the animals are wedge shaped in outline, have exceptional development of barrel (abdomen), udder and mammary system, are angular and carry little excess flesh. The typical dairy cow is a series of wedges. Viewed from the side, the top line and the bottom line form a wedge in front; viewed from the front, the shoulders form a wedge at the top; viewed from the top, the lines from the hooks to the withers form a wedge. Beef type and dairy style illustrate form developed for different functions.

Pure-Breds Versus Grades.—A pure-bred animal is one the sire and dam of which are pure-bred and registered in the herd book of a recognized breed. A breed is a group of animals similar in characteristics. Any breed is started by recording animals that have certain qualities and is maintained by recording only their offspring or only such as meet certain standards. Improvement in livestock breeding is brought about through careful selection within the different breeds. Good pure-bred sires of a recognized breed are then mated with common animals to bring about improvement. A grade is an animal of which one of the parents was a pure-bred, or one that carries 50 per cent or more of the blood of a recognized breed. The daughter of a pure-bred sire and a common cow is a grade. A scrub or common animal is usually lacking in definite quality and is of "unknown" parentage.

Pure-bred animals are more valuable than grades and grades are more expensive than scrub or common cattle. In starting a herd the kind of cattle selected depends upon the capital available. Pure-bred dairy cattle are more costly than grades because their ancestors have been selected for many generations for their ability to produce large quantities of milk and butter-fat, and it is expected that they will transmit these qualities to their offspring. Not all pure-bred dairy cows are good milk producers. There are a few poor ones, but pure-bred cows on the average will produce more than grades.

Grade dairy cattle are good producers because they have been graded up by the use of good pure-bred sires and have been carefully selected for milk production. There are high producers among grade cows, but they do not transmit their production to their offspring so uniformly as pure-breds. Common cows of mixed ancestry will occasionally be good milk producers, but there is little chance that they will transmit their good qualities to their daughters. No matter what kinds of females are selected, always use a pure-bred dairy bull.

FIG. 11.—Students of agriculture judging dairy cows at the farm of a good dairyman.

Starting the Herd.—When starting the dairy herd, it is necessary to purchase some cows or younger females. In doing this, certain definite things must be kept in mind. (Fig. 11).

Age.—Cows ordinarily freshen or calve the first time at about two years of age. Their useful period extends from that time until they die or are sold. For an average herd, cows should not be kept after they are eight or nine years of age, since their production is lessened after that age and they do not breed so regularly. For the beginner, it may be well to purchase young cows that have had one milking period so that something is known about their production. Cows increase in productive ability according to age somewhat as follows:

	Percentage of Maximum Production
2 yrs. to 2 yrs. 5 mos	72½
2 yrs. 6 mos. to 2 yrs. 11 mos	77½
3 yrs. to 3 yrs. 5 mos	82½
3 yrs. 6 mos. to 3 yrs. 11 mos	87½
4 yrs. to 4 yrs. 5 mos	92½
4 yrs. 6 mos. to 4 yrs. 11 mos	97½
5 yrs. to 8 yrs	100
9 yrs. and thereafter—a decrease	

Value.—The value of a cow to the buyer depends upon what she can return as income. First the age will indicate the number of years of usefulness. Then the beef value of the animal at the time of her leaving the herd and the veal value of the calves must be considered. These are much higher in such breeds as the Shorthorn, Red Poll, Holstein and Ayrshire than for the Jersey and Guernsey. In the case of pure-breds, the males have a breeding value, otherwise they have only a beef value. The calculation of the estimated production in milk or butter-fat per year at the local price should indicate the gross returns from such a source. Buy cows that will return a good margin of profit. Cheap cows are often dear.

Health; Soundness.—A cow not in good health is a liability. Always buy healthy cattle. Tuberculosis, a contagious disease prevalent in cattle, can be readily detected by the tuberculin test. Be certain that any cattle purchased have passed the tuberculin test, and, if possible, are from herds that are accredited by the state and federal government as having been free of the disease for some time. If possible, buy only animals from herds free from contagious abortion. Examine animals to see if their teats are free from obstructions and that there are no lumps in the udder. Easy-milking cows that do not kick should be preferred.

Ancestors.—According to the laws of heredity, "like tends to produce like." If possible, select the daughter of a great producing cow, sired by a bull whose daughters, dam, and sisters have been proven good producers. Private records, cow-testing associations, and official records for advanced registry are useful in determining the producing capacity of ancestors.

Conformation; Type.—The desirable points of conformation indicate to a certain extent the development of the milk-producing functions in the cow and her strength and general vigor. Some points are indications of beauty of form. A cow of desirable type is more valuable and will sell for more money than a rough, ill-formed one. This is especially true in the case of pure-bred animals.

A herd can be started by purchasing the full number of milking cows or by purchasing a part and letting the increase bring the herd up to the full number. The method to be used depends upon the conditions and the price of cattle.

Choosing the Herd Sire.—Most of the improvement that occurs in a dairy herd is brought about by the sire, so his selection is important. It goes without saying that the bull should be healthy and free from disease. Bulls are usually sold as guaranteed breeders. A young bull is more active and usually more sure. An older bull may have daughters that have proven their ability. From that standpoint he should be preferred.

Conformation.—Type is of great importance in a sire, for it is through him that improvement is to be brought about in the herd.

Pedigree.—A pedigree is a chart or diagram of the ancestors of an animal by generations and usually contains, for dairy cattle, records of production and show-ring winnings. The males always appear at the top of the brackets. As an illustration a sample of a good pedigree is given. It is evident that the dam and both granddams have excellent records and that the sire and both grandsires have high producing daughters.

Varsity Piebe La Vertex
No. 302952
19 daughters average in 1 year as 3-yr.-olds:
19,235 lbs. milk
702.56 lbs. fat

King Piebe Pontiac Segis
No. 174303
18 daughters average in 1 year
17,244 lbs. milk
610.87 lbs. fat

Piebe Laura Ollie Homestead King
No. 110474
46 daughters average
628 lbs. fat in 1 year

Beauty Girl Pontiac Segis
No. 229260
Record 1 year at 3 years
24,924 lbs. milk
890.33 lbs. fat

La Verna Lincoln
No. 227365
Record 1 year
29,555 lbs. milk
1048.46 lbs. fat

Prince Ormsby Mercedes De Kol
No. 47008
4 daughters average in one year
21,668 lbs. milk
797.17 lbs. fat

La May
No. 122176
Record 1 year
26,660 lbs. milk
773.49 lbs. fat

Galton's Law.—In substance this law is that an animal inherits, on the average, a definite mathematical percentage of the qualities or characteristics of each ancestor as follows: from immediate parents 50 per cent; from grandparents 25 per cent. The next preceding generation would have eight ancestors and the total influence would be 12½ per cent. Each ancestor in that generation would have an influence of only 1½ per cent. The generation preceding that would have sixteen ancestors with a total influence of 6¼ per cent; all earlier ancestors in proportion, total 6¼ per cent. It is evident therefore that back of the first two generations the chances of inheriting from a single great animal are very small.

SCORE CARD FOR DAIRY COWS

(U. S. Dept. Agr.)

POINTS		PERFECT SCORE	PERCENTAGE VALUE	STUDENT'S SCORE	INSTRUCTOR'S SCORE
1. General form		9			
Wedge shaped, when viewed from side, top, and front	6				
Size for the breed—Jersey, 900 pounds; Guernsey, 1100 pounds; Ayrshire, 1100 pounds; Holstein, 1300 pounds	3				
2. Quality		7			
Hide—thin, mellow, pliable, and loose	2				
Hair—fine, soft	1				
Secretions—abundant, yellowish	1				
Flesh—muscular, free from bunchiness	1				
Veins—large and prominent	1				
Bone—fine and clean	1				
3. Head		6			
Forehead—broad between the eyes and dished according to breed	1.0				
Face—medium in length, clean cut in outline, dished below eyes	.5				
Nostrils—large	1.0				
Muzzle—broad, but not coarse	1.0				
Jaws—wide at base, strong	.5				
Ears—medium sized, thin, hair fine, blood vessels showing, secretion abundant	.5				
Eyes—full, prominent, clear and bright	1.0				
Horns—small at base, incurving, attached close together at poll	.5				
4. Neck		2			
Moderately thin, of good length, nearly free from loose skin, neatly joined, throat clean					
5. Forequarters		11			
Shoulders—withers sharp; shoulder blades lean	2				
Chest—broad and deep; well-sprung foreribs; large heart girth; moderately full crops; brisket, light	8				
Forelegs—straight, fine bone, strong	1				
6. Body—capacity		18			
Back—straight, strong, vertebrae prominent	5				
Ribs—long, flat, well-sprung, wide apart	3				
Abdomen (barrel)—long, deep, broad, well held up; loin broad, strong, and level; flanks low	10				
7. Hindquarters		12			
Hooks—wide apart, prominent	3				
Rump—long, wide, level	3				
Pin bones—widely spaced, on level with hooks	3				
Thighs—incurving; escutcheon broad, extending well up on pin bones	1				
Tail—tapering, fine boned, long and neatly set on; switch, long	1				
Hind legs—squarely placed, not sickle-hocked, bone fine	1				
8. Mammary system		35			
Udder—large; quarters even and not cut up between; extending well up behind and well forward in front; not fleshy; soft and pliable	20				
Teats—squarely placed; even in size; of convenient size for milking; free from lumps, not leaky or hard to milk	8				
Mammary veins and wells—veins long, branching, tortuous, entering body well forward; wells large	7				
Total		100			

Indicate score on the following basis: 1.0, perfect; 0.9, very slight defect; 0.8, slight defect; 0.7, defective; 0.6, marked defect; and 0.5, poor.

The number of points given for any particular part of the animal should be multiplied by the per cent given that part by the student. For example, an animal with defective wedges is given a rating of 0.7, which, multiplied by 6, the point allowed for perfect score, gives 4.2 as the final score for wedge-shaped.

SCORE CARD FOR DAIRY BULLS

(U. S. Dept. Agr.)

POINTS		PERFECT SCORE	PERCENTAGE VALUE	STUDENT'S SCORE	INSTRUCTOR'S SCORE
1. General form		16	....	....	....
Masculinity	11				
Size for the breed—Jersey, 1300 pounds; Guernsey or Ayrshire, 1600 pounds; Holstein, 1800 pounds	5				
2. Quality		10	....	....	....
Hide—thin, mellow, pliable, loose	3				
Hair—fine, soft	2				
Secretions—abundant, yellowish	1				
Flesh—well muscled, free from bunchiness	1				
Veins—large and prominent	1				
Bone—strong and clean	2				
3. Head		10	....	....	....
Forehead—very broad between the eyes, slightly dished	2				
Face—medium in length	1				
Nostrils—large	1				
Muzzle—broad	2				
Eyes—prominent, large, clear, bright	3				
Horns—well proportioned	1				
4. Neck		5	....	....	....
Medium in length, very large, prominent crest; neatly joined; throat free from loose skin.					
5. Forequarters		16	....	....	....
Shoulders—withers moderately sharp; well muscled	5				
Chest—broad, deep, large heart girth, crops full, brisket moderate in size	10				
Forelegs—straight, squarely placed, wide apart, strong bone	1				
6. Body—capacity		19	....	....	....
Back—straight, strong, vertebrae prominent	7				
Ribs—flat, well sprung, wide apart	2				
Abdomen (barrel)—long, deep, broad, well held up; loin broad, strong, level; flanks low	10				
7. Hindquarters		16	....	....	....
Hooks—wide and prominent	3				
Rump—long, wide, level	6				
Pin Bones—widely spaced, on level with hooks	4				
Thighs—incurving	1				
Tail—tapering; fine bone; neatly set on; long, fine switch	1				
Hind legs—squarely placed, not sickle-hocked, bone clean and strong	1				
8. Rudimentaries		6	....	....	....
Teats—squarely and evenly placed; large	3				
Mammary veins—large, tortuous	2				
Milk wells large	1				
9. Scrotum		2	....	....	....
Well-developed—strongly held up.					
Total		100	....	....	....

Indicate score on the following basis: 1.0, perfect; 0.9, very slight defect; 0.8, slight defect; 0.7, defective; 0.6, marked defect; and 0.5, poor.

The number of points given for any particular part of the animal should be multiplied by the per cent given that part by the student. For example, an animal defective in masculinity is given a rating of 0.7, which, multiplied by 11, the point allowed for a perfect score, gives 7.7 as the final score of masculinity.

Score Card to Judge Dairy Cattle.—To establish the relative importance of the different parts of the animal and to familiarize students and new breeders with the different points to be judged in cattle, score cards have been made. Each breed has a score card, but the dairy-cow score card submitted may apply to each breed to a great extent. The descriptive terms for the various parts of the body are those in common use. Parts of the animal may be located on the chart showing points of a dairy cow (Fig. 12).

DAIRY CATTLE COMPARATIVE SCORE CARD

CONTESTANT'S NAME OR NUMBER............................CLASS................

Instructions—First make your comparison of each animal as indicated by details in I, II, III, IV, V. Then place them as a whole, all things considered.

DETAIL COMPARISONS—Emphasizing the more important evidence of:	Judges and Contestants Placing (Contestants use upper line)					
	1st	2nd	3rd	4th	5th	6th
I. *Constitution:* Indicated by deep, wide chest; large heart girth; wide between forelegs; nostrils large and open; eye prominent, large and bright.						
II. *Feed Capacity:* Indicated by a long, deep, wide middle; great spring of rear rib; wide loin; length partly determined by width between ribs. Feed capacity also indicated by large, broad muzzle and deep jaw.						
III. *Dairy Character:* Indicated by a clean-cut, open conformation and angular form. Lack of flesh over shoulders, loins, rump and thighs. Slim ewe neck; quality of skin being thin and pliable. (Dry cows and heifers near freshening are expected to carry more flesh than those in milk, so should not be criticized too strongly on dairy character.)						
IV. *Mammary or Milk System:* Indicated by a large udder, attached high and wide behind, extending down to a fair depth, and carried well forward. Udder of fine quality and texture free from fleshiness. The udder should be of good form, evenly balanced, level on the floor, and teats of a uniform size and squarely placed. Mammary or milk veins, long, large and tortuous (crooked). Large milk wells. (*Bulls:* consider masculine character as shown by boldness of head, prominent crest on neck, strong constitution, well-developed rudimentaries (or teats) that are squarely placed.)						
V. *Breed Type:* Indicated by a clean-cut feminine head (masculine in bulls). A straight top line; a strong loin, a long, wide, level rump, wide at the pin bones. Pleasing style of animal as shown by alertness and a symmetrical or well-proportioned body. Scale or size that should be up to average or larger for the breed. The breed differences as to form of head and color should be considered.						
Final Placing: Considering animals as a whole with due regard to relative merits, defects and soundness.						

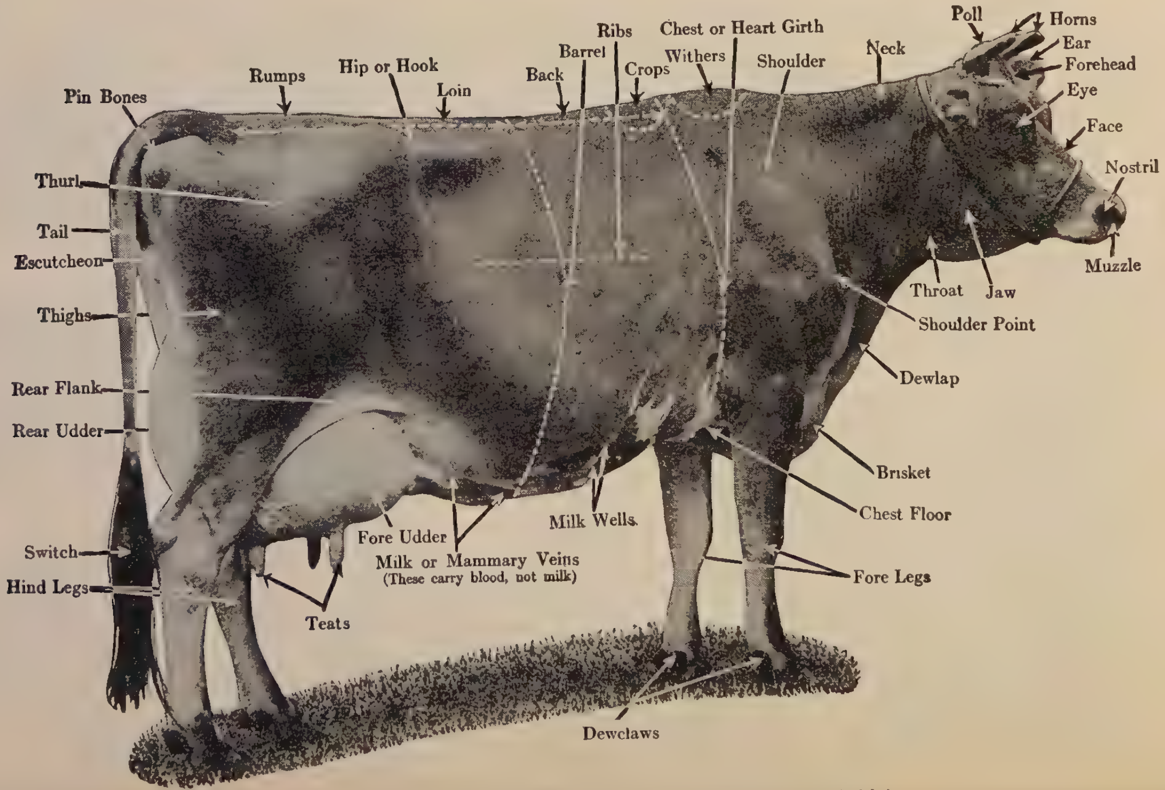
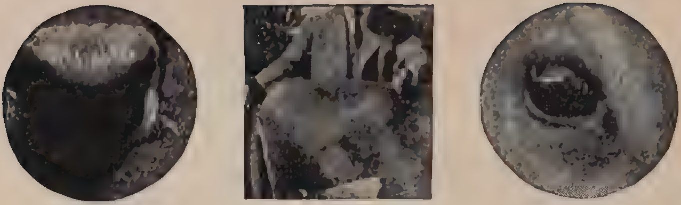
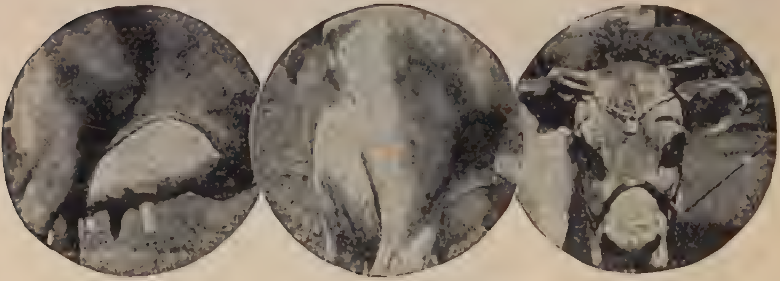


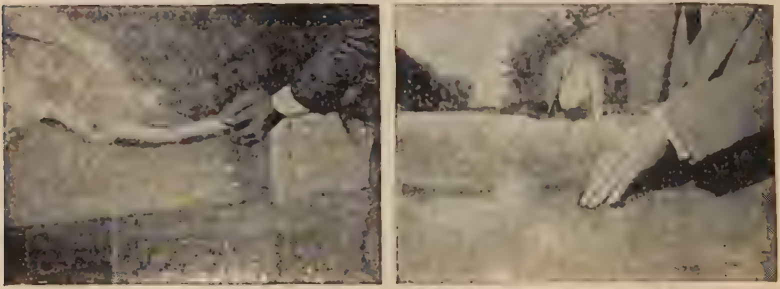
Fig. 12.—The points of the dairy cow. ("Livestock Judging," by Smith.)



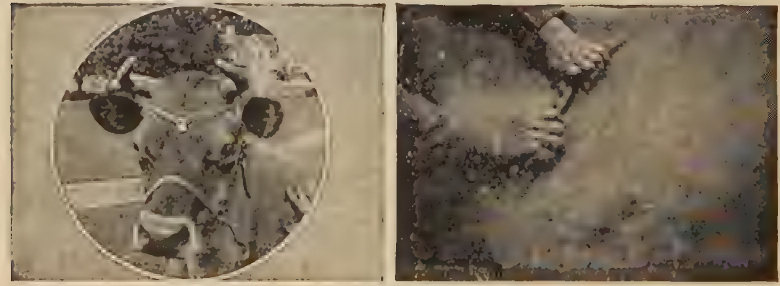
Nostrils large, lips strong. Long level rump. Eye large, full, placid.



Udder level, well forward, teats good size, evenly placed. Udder large, broad and high behind. Head rather long. Forehead wide, high.

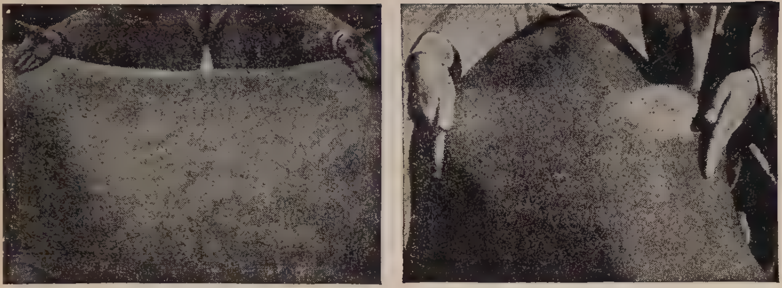


Milk veins large, crooked, well forward. Milk wells large. For dairy temperament—openness of ribs and spine.



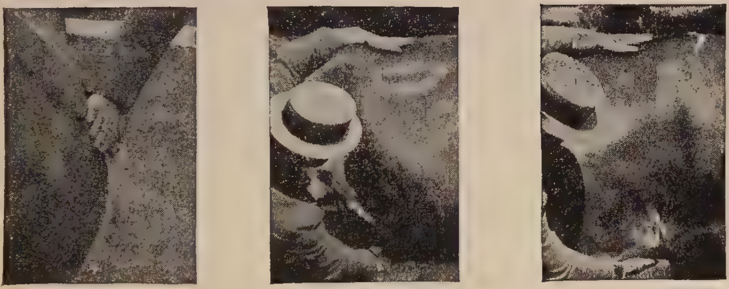
For quality—a fine, clean head. A fine, loose, pliable skin.

Fig. 13.—Points to consider in selecting a profitable dairy cow. (J. H. McLain.)



Body long for feed capacity.

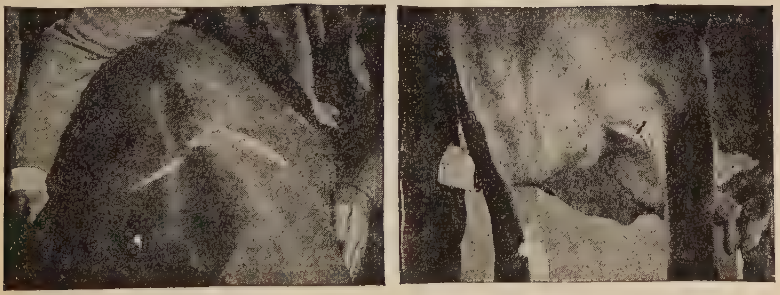
Loin broad and level.



Ribs well rounded.

Body deep at flank.

Deep at chest



Fore ribs well sprung.

Floor of chest wide.

FIG. 14.—Points to consider in selecting a profitable dairy cow. (J. H. McLain.)

To use the score card, take the back as an example. In the animal studied, the back is somewhat defective and therefore should score 70 per cent of perfect. Then the 5 points allotted to back would be multiplied by 70 per cent—5 x .70=3.5 points in score for the back. Other parts are scored in the same similarly. The score card for bulls is likewise.

After practice in scoring has familiarized the parts of the animal and their approximate relationship to each other (Figs. 13 and 14), judging is conducted by the comparative method. A comparative score card is useful at first, but judging is later done by ranking the animals in the order of their merit.

Job 4. Planning Rotations and Pastures

Conditions Usually Found.—(1) Dairying is most profitable where suitable pastures and crops can be grown for feeding. (2) Few dairymen buy all of their feed.

Aims.—Beginners should understand the planning of good rotation systems for dairy farming. (2) They should know the details of establishing and maintaining good pastures.

Problems for Study and Discussion.—(1) What are the rotations on the best dairy farms of your region?

2. How could you improve upon some of these rotations?
3. Ask farmers their opinions regarding improving of their rotations.
4. In what respects are permanent pastures better than temporary pastures for dairy herds?
5. Give the advantages of temporary pastures.
6. Describe some system of farming where temporary pastures are provided.
7. What are the best grasses and legumes for permanent pastures in your region?
8. Which crops would you use for temporary pastures?
9. Give suggestions for maintaining permanent pastures successfully.

Activities.—Make a collection of the best pasture grasses and legumes. Dry the specimens and mount them for permanent use at home or at school. On each sheet write the use and season of planting and the season of pasturing each of these. (2) Make a wall chart of the best farm rotation for dairying which you can find or plan.

Dairy-Farm Rotations.—The typical farm rotations for the middle western and northwestern regions are the following:

(1) corn (2) small grain (3) clover
or (1) corn (2) small grain (3) clover (4) grasses.

In the year when clover is cut, the second growth is often used as a temporary dairy pasture. It is well to have a small permanent pasture for use in the first half of each summer until the second growth of clover is ready for pasturing.

West of the clover-growing states, alfalfa is substituted for this crop; the alfalfa is probably the best crop for hay for dairy cattle. Sweet clover is often substituted.

Summer silage, stored in a silo of small diameter, is often used to supplement pastures during dry seasons.

Western Rotation.—In the regions having less rainfall than the clover belt, such grain sorghums as kafir, milo, and feterita are used in place of corn in the rotation. Rotations are usually much longer because of alfalfa displacing the clover. Suitable grasses are sown or omitted from the rotation. Smooth brome grass is popular for hay and permanent pastures and sudan grass for hay and summer pastures in the Dakotas and other dry regions.

A Rotation for the South.—The dairy rotations outlined are suitable as far south as the Gulf States. Where alfalfa has found a place on southern farms, it takes the place of clover and grass for dairying. Cowpeas and soybeans are abundantly grown for hay. No one grass crop has found a permanent place in short rotations in the Gulf States.

Perhaps the most popular dairy rotation would be in the following order: (1) corn or sweet sorghum, with or without a companion crop of soybeans, cowpeas, or velvet beans; (2) a winter cover crop of crimson clover, oats and winter vetch; (3) cowpeas or soybeans for hay for temporary pasture; (4) a winter crop as before or fall oats grown for grain.

Good Pasture Crops.—Some qualities of a good pasture grass are given: (1) lives for many years; (2) forms an even sod, not in bunches; (3) endures drouth well; (4) is shallow rooted to endure poor drainage; (5) endures tramping of livestock; (6) begins growth early in spring and continues growth through much of the cool weather of spring and fall; (7) is palatable; (8) makes new growth quickly after cropping (Fig. 15).

Dairy Pastures.—Among the best crops for permanent dairy pastures are blue-grass, white clover, timothy and other grasses. In the Northwest, alfalfa and smooth brome grass are extensively pastured. In the Gulf States, Bermuda grass prevails in permanent pastures and lespedeza is abundantly found with it.

Temporary pastures may be grown with such crops as red or alsike clover, soybeans, and oats and peas mixed. Winter grain or other winter cover crops may be pastured during suitable weather when the soil is not too muddy. Corn fields where such legumes as cowpeas and soybeans have been sown in the corn make good late-fall pastures after the ears of corn are gathered.

Pasture Mixtures.—The benefits of growing several different kinds of plants together for pasture or for hay should be noted. (1) There are different depths of feeding of roots, avoiding competition, and using the soil to better advantage. (2) Some may endure the shade of others and thus cover the surface better. (3) Plant-food requirements differ. (4) Some thrive better in heavy soils while others thrive better in sandy or otherwise different spots, as alkali, or lime, or sour soil. (5) Some grow better in cool, moist weather and others endure the hot, dry seasons.

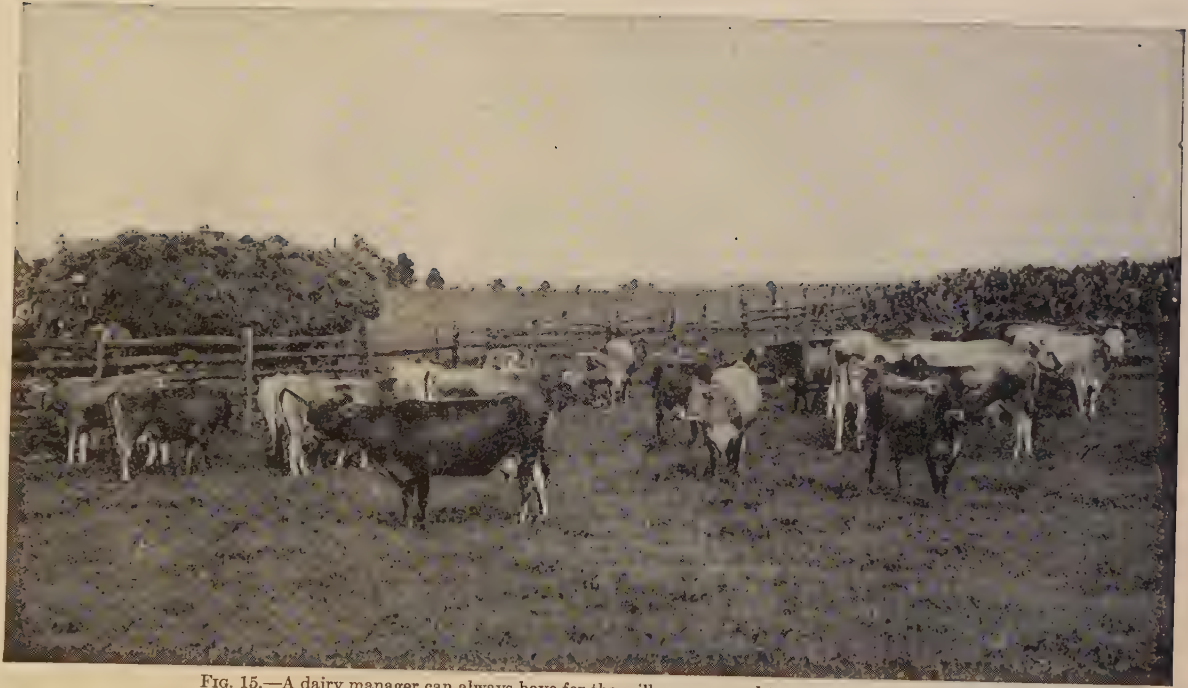


FIG. 15.—A dairy manager can always have for the milk cows a good temporary or permanent pasture not far from the barn. (Cromwell, "Agriculture and Life.")

(6) Some endure close cropping, while others remain succulent when allowed to grow tall.

Alfalfa and sweet clover are often used as temporary pastures at suitable times in their growth when the cattle will do least damage to the plants. Red clover and alsike clover are often pastured the first year and the last half of the second year. They form excellent temporary pastures.

Maintaining Pastures.—Permanent pastures are those which are fenced and seeded with long-lived perennial crops which will endure pasturing well. The crops in permanent pastures are made to endure the treatment better in several ways: (1) By reseeding thin or bare spots; (2) by harrowing when ground tends to crust or bake; (3) by mowing the weeds and preventing them from seeding; (4) by top dressing with lime and commercial fertilizers; (5) by not pasturing too closely nor too early in the spring; (6) by removal of livestock when the soil is muddy.

Pasture Areas.—Permanent pastures are often located on parts of the farm not best suited to cultivated crops, such as low wet lands, wood lots, stumpy fields, rocky fields, poor uplands, steep hillsides, and combinations of any of these. Such conditions make it impossible to establish a rule regarding the area of pasturage per cow. Good pastures of bluegrass and white clover should yield enough pasturage from two or three acres for a mature cow during pasture season. Temporary pastures usually do much better than this.

Supplementary Pastures.—In dry summer weather pastures become very short and milk flow is often greatly reduced. Milk cows at this time should be turned on temporary pastures provided for this season. Soiling crops may be provided with less difficulty. Green corn from which roasting ears have been marketed is excellent for summer soiling. Green sorghum crops are often used for this purpose. Alfalfa fed green or dry will keep up the milk flow during the dry season.

Job 5. Caring for Calves and Young Stock

Conditions Usually Found.—(1) Little preparation is made for calving and calves frequently run with their mothers for a long time. (2) The feeding of calves is done in a haphazard manner that frequently results in stunted, undersized animals.

Aims.—Students should become familiar with the proper methods of care and management of dairy calves.

Problems for Study and Discussion.—(1) How long should the cow be rested before freshening, and why? Ask neighbors how long they let their cows rest.

2. What precautions are essential at freshening time?
3. What is colostrum and why is its use necessary?
4. What determines the quantity of milk to be fed the young calf? What is the local practice?

5. What are necessary precautions in calf feeding?
6. Explain the feeding of hay to the calf from birth until two years of age.
7. Explain the feeding of grain in like manner.
8. What hays and grains are used locally?
9. What are milk substitutes and how and when used?
10. What substitutes are used by local farmers?
11. Describe rations used by best local dairymen.
12. What are common calf ailments? How are they detected and treated?
13. What troubles have proved most serious in your region?
14. At what age should heifers be bred and at what age should the young bull be used for service?
15. Ask local dairymen regarding these points.

Activities.—(1) Teach calves to drink milk from a pail. (2) Treat calves to prevent growth of horns. (3) Run a trial to compare the cost of raising calves with and without whole milk. (4) Assist in castrating dairy calves. (5) Treat calves for lice, using two methods for comparison. (6) Find calves affected with scours and administer proper treatment. (7) Build a dipping vat and assist in the dipping of young stock to combat ring worms, lice and ticks.

Caring for Cow Before Freshening.—Calf raising begins with the feeding and care of the cow before freshening. A healthy cow in good physical condition will probably drop a strong healthy calf. During the dry period of a month to six weeks before calving, the cow should be well fed. In other words, she should have a vacation on full feed. Plenty of pasture in the summer or good hay together with some grain at other seasons insures proper condition for calving. For a week before calving the only grain fed should be oats or bran.

In summer with large shady pastures available no provision need be made for calving. In the winter, or in inclement weather, a large clean box stall well bedded-down with clean straw is the best place for the cow at freshening time. Cleanliness is essential; in preparing the stall, therefore, all previous litter should be removed and the sides and floors should be sprayed with a 5 per cent solution (1 part to 19 parts of water) of carbolic acid or some standard disinfectant. Then clean bedding is put into the stall. After such preparation the calf has a chance to start life healthy and free from infection. In summer in a large shaded pasture, where a cow can get off by herself, there is no need to use a box stall.

Caring for the Cow and Calf at Freshening.—The indications of approaching calving are a swelled or distended udder and a relaxation and sinking of the muscles and tendons of the rump on either side of the tail head. The latter symptom usually occurs between 24 and 48 hours before calving. A cow wants quiet at freshening time, so should be left undisturbed as much as possible. If an attendant is present at calving time, care should be taken to see that the foetal membrane is immediately removed from the nose of the calf so that it may start breathing. Rubbing the calf's throat helps to clear it of mucus and to start body functions. Usually the cow starts immediately to lick the calf against the hair.

This stimulates the circulation and also dries the calf. If the cow does not lick the calf, rub it vigorously with a clean cloth. As soon as possible, apply tincture of iodine or some other antiseptic to the navel by means of a swab. A pail of warm water for the cow to drink is advised after calving. This may be followed by a bran mash, warmed in winter. A healthy cow usually passes the afterbirth within a day after calving. If this does not occur, it is well to consult a veterinarian.

The first milk or colostrum, the thick, yellowish, viscous fluid that a cow gives immediately after calving, is essential to start the calf's body functions. Be sure that the calf gets this milk.

Feeding the Young Calf.—The dairy calf may be separated from the cow immediately after it has sucked for the first time or may be left with its dam for the first four days, being weaned the fifth morning. It is then taught to drink from a pail by allowing it to suck two fingers held in a pail of milk. Usually one or two lessons will teach the calf to drink. From that time on it is fed in a pail, and the quantity of milk must be carefully weighed at each feeding. The weight, breed and condition of the calf and the number of daily feedings determine the quantity of milk to be used. In general, at the start, Jersey and Guernsey calves may be fed one pound of milk to each 9 or 10 pounds of live weight, while calves of the other breeds may receive one pound of milk for each 8 pounds of live weight. The calf-feeding schedule gives indication of the quantities of various feeds to be used for the first six months.

A few precautions are necessary in caring for calves as follows: (1) Always leave the calf a little hungry. (2) Feed all milk at a temperature of between 95 and 100 degrees F. (3) Always weigh or measure all milk for calves. (4) Change quantities of milk gradually. (5) Cleanliness is essential in pails, feed boxes, stalls, in fact everything connected with calves. (6) Rich milk, over 4 per cent fat, is not well suited for calf feeding and should be diluted with warm skim-milk.

The grain for feeding calves may be of various kinds of which the following are examples:

1	2	3
Cracked corn	1 part cracked corn 1 part wheat bran	2 parts cracked corn 1 part ground oats 1 part wheat bran

4	5	6
1 part ground oats 1 part wheat bran	5 parts cracked corn 2 parts ground oats 2 parts wheat bran 1 part linseed meal	5 parts rolled or ground barley 2 parts ground oats 2 parts wheat bran 1 part linseed meal

Grain is conveniently fed in small feed boxes fastened to the side of the stall.

Calf Feeding, First 26 Weeks

Weeks of Age	Whole Milk per Day			Skim-Milk per Day			Grain per Day	Hay per Day	Silage per Day
	Jersey, Guernsey, Ayrshire	Shorthorn, Ordinary Cows	Holstein, Brown Swiss	Jersey, Guernsey, Ayrshire	Shorthorn, Ordinary Cows	Holstein, Brown Swiss			
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	6.0– 9.0	8.0–12.0	9.0–12.0						
2	6.0– 9.0	8.0–12.0	9.0–12.0						
3	8.0–10.0	10.0–14.0	11.0–14.0				0.2	0.2	
4	8.0–10.0	10.0–14.0	11.0–14.0				0.3	0.4	
5	Substitute skim for whole, 1 lb. per day	Substitute skim for whole, 1 lb. per day	Substitute skim for whole, 1 lb. per day	Use same quantity as 4th week	Use same quantity as 4th week	Use same quantity as 4th week	0.5	0.6	
6	Stop	Stop	Stop	12.0	14.0	14.0	1.0	1.0	
7	If calf is weak use whole milk longer			12.0	14.0	14.0	2.0	2.0	
8				12.0	14.0	14.0	2.5	2.5	
9				14.0	16.0	16.0	2.5	2.5	
10	A calf will consume more milk with good results if fed three times rather than twice a day for the first few weeks			14.0	16.0	16.0	2.5	2.5	
11				14.0	16.0	16.0	2.5	2.5	
12				16.0	18.0	18.0	3.0	3.0	2.0
13				16.0	18.0	18.0	3.0	3.0	2.0
14				16.0	18.0	18.0	3.0	3.0	3.0
15	Calves need water after the second week and need salt at a month of age			16.0	18.0	18.0	3.0	3.0	3.0
16				18.0	20.0	20.0	3.0	3.0	4.0
17				18.0	20.0	20.0	3.0	3.0	4.0
18				18.0	20.0	20.0	3.5	3.0	4.0
19				18.0	20.0	20.0	3.5	3.0	4.0
20	1 quart of milk equals 2.15 lbs.			20.0	20.0	20.0	4.0	4.0	4.0
21	1 pint of milk equals 1.075 lbs.			20.0	20.0	20.0	4.0	4.0	4.0
22	(Practically, a pint equals a pound)			20.0	20.0	20.0	4.0	4.0	4.0
23				20.0	20.0	20.0	4.0	4.0	4.0
24				20.0	20.0	20.0	4.0	4.0	4.0
25				20.0	20.0	20.0	4.0	4.0	4.0
26				20.0	20.0	20.0	4.0	4.0	4.0
				Skim-milk may be continued longer but it is not necessary					

Hay for calves should be fine in texture and of good quality. Prairie hay, timothy, blue-grass, clover and other hays are suitable. Alfalfa is frequently used but sometimes causes scours. A small rack for hay should be conveniently placed in each calf pen. Pasture is good for calves but should not be depended upon to supply all the feed for young calves, and should not be used very early in the spring when the grass is watery. Silage may be used to advantage for calves that are over three months old, but is not advisable before that age.

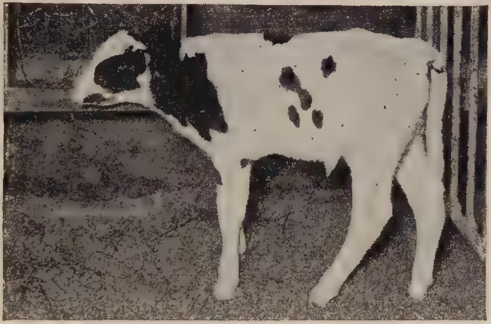


FIG. 16.—Calf pen showing tilting window, hay rack, and manger.

Calf Management.—Birth to Six Months.—Cleanliness and the other precautions at calving time help to prevent navel infection and other disorders. When taken from its mother, the calf should be kept for a week or more in a small pen by itself (Fig. 16). Later it may be put into a larger pen with other calves. When this is done, feed dry grain after feeding milk and keep the calves tied or stanchioned for a time to prevent them from sucking each other. (Figs. 17 and 18). Calf

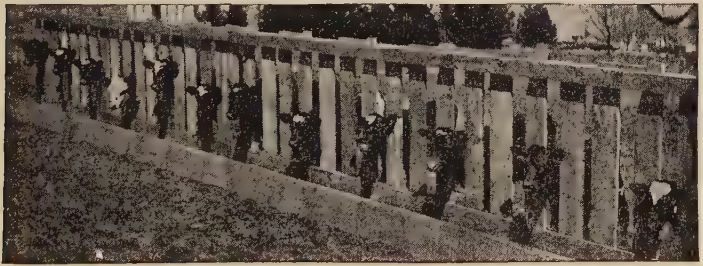


FIG. 17.—Stanchions for calves to prevent the strong from stealing the food of the weaker and to prevent all from sucking one another.

stanchions are a great convenience in feeding and may be easily constructed. Their use insures that each calf gets its proper feed of milk and prevents sucking afterwards.

Preventing Horns.—Since horns serve no useful purpose in the average dairy herd, simple precautions may be taken to prevent their growth. Between the third and fifth day, the hair should be clipped from around each small horn knob or button on the calf's head. Just inside the clipped area put a ring of vaseline. Then with a stick of caustic potash or caustic soda, moistened at one end and with the other wrapped in paper to protect the hand, rub over the horn button until the skin is burned through. Applying the caustic alternately from one button to the other is advised. The area burned or cauterized should be about the size of a dime. After being treated, the calves should be kept out of the rain and should not be allowed to lick each other or to rub their heads against anything for an hour or more. (See Job 10, beef enterprise.)

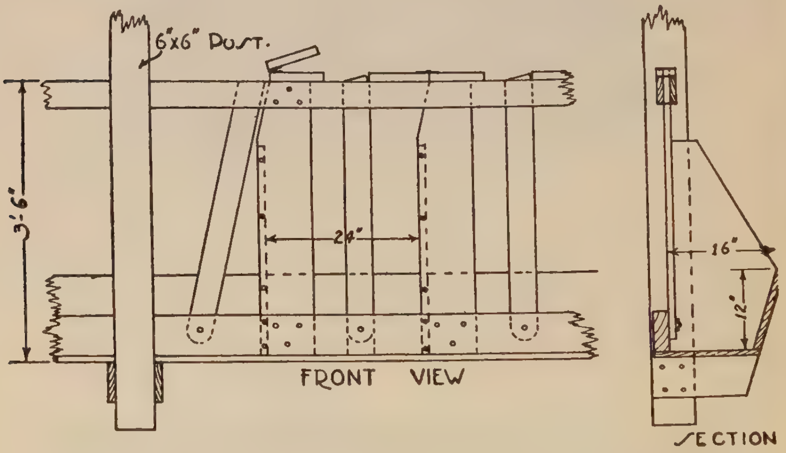


Fig. 18.—Calf stanchions: one lift open, the other closed. Section view at right. Students may use this as a working drawing when making calf stanchions.

Stalls and pens for calves should always be dry and clean (Fig. 16). Plenty of bedding is needed in the winter to prevent dampness from the floor causing pneumonia. Adequate ventilation is another essential for a calf pen. Clean water in abundance and plenty of salt are needed by calves after they are two to three weeks of age. Bull calves should be separated from the females at about three months of age and thereafter kept in separate pens. (See Job 10, beef enterprise, for method of castrating).

Marking Calves.—Dairy calves may be marked for identification by means of ear tags inserted in the ears, by means of notches or holes in the ears, by straps around their necks to which numbers are attached, or by tattooing in the ears.

Registering Calves.—Pure-bred calves should be registered when they are about six months of age. Registering earlier, even when allowed, may cause the owner to register some that are not worthy. Be sure that the calf is worthy of being kept as a breeding animal before registering is done. Delaying the registration is dangerous, because records may be lost and the memory should not be strained too long. Buyers have more confidence in breeders who tend to prompt registration. Blanks for registration and transfer of animals are furnished by breed associations. Ask for a copy of rules regarding naming, marking, registering, and keeping a herd book.

Milk substitutes are useful when milk and skim-milk have a high value, as in regions where whole milk is sold. Calves under such circumstances are raised upon the minimum of milk, either whole or skim. It must always be remembered that there is nothing so good as sweet milk for feeding calves. Among the substitutes are buttermilk and whey, and while both are usually sour at the time of feeding, the calves get used to them and do fairly well. Various calf meals that can be used as gruels as substitutes for milk are on the market. A home-made calf meal used by the U. S. Bureau of Dairying is as follows:

Pounds	
50	corn meal finely ground
15	linseed meal
15	oats finely ground and rolled
10	dried-blood flour
10	skim-milk powder
½	salt

Stir one-half pound of the mixture into 4½ pints or pounds of boiling water and feed when sufficiently cool. This constitutes one feed or one-half the daily feed for a calf one month old. As the calf gets older, the quantity may be increased until at 2 months of age the calf is receiving 1½ to 2 pounds of the meal mixed with water.

If substitutes are used for milk in feeding calves they should not be started until the calf is a month old and should then be substituted for the whole milk a little at a time.

Measuring Calf Growth.—Growth in calves is ordinarily determined by gain in weight. It is useful therefore to have a standard by which to measure growth. The tables presented indicate the weights and gains possible under a good system of management.

Weight of Dairy Heifer Calves at Different Ages

Breed	Birth	3 Months	6 Months	9 Months	12 Months
	lbs.	lbs.	lbs.	lbs.	lbs.
Jersey	50	130	265	380	500
Guernsey	65	150	320	460	550
Ayrshire	65	150	330	475	560
Holstein	90	220	400	575	735

Daily Gains in Weight, Dairy Heifer Calves at Different Ages

Breed	Range in Birth Weights	Birth to 3 Months	Birth to 6 Months	Birth to 9 Months	Birth to 12 Months
	lbs.	lbs.	lbs.	lbs.	lbs.
Jersey	40–60	0.7—1.0	1.0—1.3	1.2—1.5	1.2—1.6
Guernsey	50–70	0.8—1.0	1.2—1.6	1.3—1.7	1.3—1.7
Ayrshire	50–70	0.9—1.2	1.2—1.6	1.3—1.7	1.3—1.7
Holstein	80–100	1.3—1.5	1.5—2.0	1.5—2.0	1.6—2.2

Calf Ailments.—Scours or diarrhœa from indigestion is one of the commonest ailments of calves. It hinders or checks growth, and reduces or stops the daily gains in weight. Scours may result from many causes, such as irregular feeding both as to time and quantity of milk, overfeeding, cold milk, dirty milk or dirty utensils, milk from diseased cows, sudden change of feed, and damp or dirty pens. In fact anything that may cause a disorder of the stomach may cause scours. At the first sign of scours reduce the quantity of milk one half, clean the pens, feed boxes, and utensils thoroughly and try to remedy the cause.

Treatment.—Two raw eggs will sometimes help but cannot be depended upon; two drops of formalin in the milk for each pound of milk fed is useful; three tablespoons of castor oil (given as a drench in a long-neck bottle) followed twenty-four hours later by a teaspoon of a mixture of one part salol and two parts of bismuth subnitrate (from any druggist) will cure most cases.

White scours or infectious dysentery may appear shortly after birth and may be detected by light-colored offensive droppings. The calf is quickly weakened and usually dies within three days. The disease is very infectious and careful disinfection of the premises is necessary to prevent further spread of the disease. For treatment consult a local veterinarian.

Pneumonia in calves is very common. Prevention is the best cure.

Damp, dirty stalls and poor ventilation are conditions that frequently bring on pneumonia. The symptoms are coughing, a rise in temperature, rapid and difficult breathing, listlessness, rapid pulse, and running at the nose. Care is very important in the successful treatment of this disease. The calf should be put in clean, dry, sunny quarters that are fairly warm and free from drafts. From one-half to three-fourths of the regular quantity of milk should be fed. Raw eggs, one at a feed, are useful for supplying nourishment. The local veterinarian should be consulted for treatment. In some cases, good results have been obtained by giving once a day hypodermic injections of 8 to 10 cubic centimeters of the following mixture: 400 cubic centimeters (c.c.) of olive oil, 100 grams of gum camphor, and ¾ of an ounce of beechwood creosote.

Bloat may be relieved by tying a stick in the calf's mouth if the condition is not serious. A drench of a teaspoon of formalin in a quart of water is usually helpful. Only in very severe cases should the stomach be punctured (See Job 9).

Ringworm is caused by a minute parasite that produces in the hide bare circular spots covered with crusts. Swabbing the spots once a day with tincture of iodine after a thorough washing with soap and water is usually helpful.

Lice thrive on animals kept in unsanitary surroundings. Treatment consists of washing the animal thoroughly with a solution of one ounce of sodium fluoride in one gallon of water and repeating it in two weeks to kill the next generation. Sodium fluoride in powder form may be dusted over the infested parts in the winter when washing is undesirable. (See Job 10, beef enterprise).

Care of Young Dairy Stock, Six Months to Two Years of Age.—The principle to be followed in feeding young animals is to keep them growing every day. Grain may be fed at the rate of ¼ to ¾ pound daily per 100 pounds of live weight. Either the calf or herd grain mixture may be used. The roughage should always be of good quality, and if possible legume hay should be used. The quantity eaten will range from 1 to 2 pounds daily for each 100 pounds of live weight. Silage may be fed at rates varying from 1 to 2½ pounds daily per 100 pounds of live weight. In pasture season, with good pasture available, grain may not be necessary; but it is essential with short pastures.

Shelter.—In the southern half of the United States and in many other sections, all the shelter needed is an open shed throughout the year. In colder or more stormy regions more protection may be necessary. With plenty of feed and bedding and protection from wind and rain, cattle can stand a great deal of cold without any disadvantage.

Management.—Plenty of exercise is essential for growing animals. Heifers are usually bred between the ages of 15 and 18 months and the gestation period is 282 or 283 days. Jersey and Guernsey heifers mature more rapidly than the other breeds and may freshen at two years, but Holsteins develop better if they do not freshen before 27 months.

A month or more before freshening, the heifer should be brought to the barn once or twice a day and put into the stall or stanchion, and her udder should be handled. This usually prevents any trouble after calving since the heifer will be accustomed to being handled.

Care of Young Bull.—Young bulls are fed and managed like heifers. A ring should be put into the bull's nose when he is six months old. He should be handled with the ring and with a halter. A little care in training a young bull may prevent trouble in handling an old bull later on. Bull calves are separated from the heifers when three months of age and should be kept separate thereafter. Not before he is a year old should the young bull be used for service and then only for a few cows.

Job 6. Feeding the Dairy Herd

Conditions Usually Found.—(1) Many farmers have their cows freshen in the spring and produce the largest flow on pasture. (2) Winter dairying is becoming more extensive because of the better demand and higher prices for dairy products in the winter. (3) For winter feeding, straw, corn stalks, and poor hay are all too common feeds for milk cows, with corn or corn and oats the sole grains.

Aims.—The best methods of feeding, the correct choice of feeds, the balancing of home-grown and purchased feeds, and the adaptation of feeds to special purposes should be learned by students.

Problems for Study and Discussion.—(1) The desirability of producing the largest milk flow on pasture as compared with winter feeding may be discussed for local conditions.

2. What is maintenance and why is it necessary?
3. What are the local pasture crops and how many cows will they support for the pasture season? What is the cost per cow?
4. What are the local dry roughages—legumes and non-legumes?
5. Balance a ration using local feeds for local cows.
6. Why will a cow not eat more than a limited quantity of hay? Of straw?
7. Define protein and give uses and need for using it.
8. Compare economy in cost per cow per day of rations using legume and non-legume roughages with that of appropriate grain mixtures.
9. Compare local dairy practices in feeding as to balancing of rations, proper grain mixture, and succulence.

Activities.—(1) Mix feeds for feeding concentrates to dairy cows. (2) Make up and mix a ration for dry stock. (3) Collect for study samples of many kinds of feeds. Place these in bottles and label them. (4) On a placard or wall chart list common dairy feeds of the region and present market prices.

Feed Plenty for Both Maintenance and Production.—Feed is the fuel that animals use for growth, the making of repairs, the performance of work, such as hauling, the laying on of meat and fat, and the production of eggs or milk. Without feed, the animal dies; with proper feed the animal transforms coarse roughages and grains into human food or work for man.

Feed is required first for the maintenance of the animal, to keep the body functions going, to make repairs, to produce new blood. This is an upkeep allowance and is needed by all livestock. Secondly, feed is required for useful work; such as pulling, in case of the horse; egg laying, in case of the hen; laying on meat and fat, in the cases of the hog and beef steer; and milk production, in case of the dairy cow. If enough feed is given to provide only for maintenance, then no work can be done. Animals, like machines, work most efficiently at capacity production. Feed enough to provide for maintenance and for maximum production.

Feeding Dairy Cows in Summer.—Pasture is the natural feed for dairy cows. It provides an assortment of grasses which are, in most sections, ideal feed. In many parts of the United States pasture is available for but a short season, and supplemental feeds must be used the rest of the year. The pasture used may be of native grasses, which vary with the climate, or it may be sown to any suitable grasses. Bluegrass, timothy, the various clovers, such small grains as rye and oats, and both the sweet and the non-saccharine sorghums, such as cane and sudan grass, are all used for pasturing. In many cases a succession of crops provides pasture throughout the season. Ordinarily, land for pasture is not used for other purposes, so that the cost of pasture depends upon the number of cows that it will feed and the number of days that it will feed them. In other words, the cow-day is the unit of measure. For example, not taking into account taxes and upkeep, but merely interest charges, if an acre will pasture a cow each day of 150 days, and land is worth $100 per acre, then at 6 per cent interest the cost of the pasture would be $6.00 for 150 days or 4 cents per day per cow. The land is usually idle the balance of the year. Pasturing reduces the labor required for dairying to the minimum.

Soiling crops (soilage), those that are grown for forage but cut green and hauled to the cows, are sometimes used where land is valuable and labor is cheap.

Silage for summer feeding is becoming more popular either in place of or supplementing pasture, particularly in dry seasons when pastures are poor.

Supplemental grain is needed for maximum production in high-producing dairy cows, in addition to pasture, soiling crops, and silage. The dairy cow has been so highly developed that she cannot eat enough bulky green feed for maximum production. For feeding on good pasture the following are suggested guides:

Summer Feeding; Jersey or Guernsey Cows

Daily Milk Range in lbs.	Proportion of Grain to Milk 1 lb. to
0–20	7 lbs. milk
20–25	6 lbs. milk
25–30	5 lbs. milk
30–35	4½ lbs. milk
35 or above	4 lbs. milk

Summer Feeding; Holstein, Ayrshire, Brown Swiss, Shorthorn, or Common Cows

0–25	8 lbs. milk
25–30	7 lbs. milk
30–35	6 lbs. milk
35–40	5½ lbs. milk
40 or above	5 lbs. milk

The grain mixtures used may vary in digestible protein content from 10 to 12 per cent. Sample grain mixtures suitable for use with pasture are given:

50 lbs. corn meal 100 lbs. wheat bran 100 lbs. oats (ground)	or	100 lbs. corn meal 100 lbs. wheat bran 25 lbs. linseed meal

Winter Feeding of Dairy Cows.—Winter feeding, or feeding when pasture is not available, is more complicated. The ideal to strive for is furnishing the cows with proper nutrients at lowest cost. This is usually accomplished by using if possible home-grown roughages, and balancing a grain mixture to use with the roughage, purchasing only such grains or concentrates as are needed to obtain the proper nutritive balance.

Roughage is any coarse feed, such as hay, straw, fodder, and silage, that contains a relatively small percentage of nutrients. Roughage may be divided into dry and succulent (juicy) roughage. Dry roughage is further divided into legume hays and non-legume hays, straws, and fodders.

Legume hays include alfalfa, the clovers, such as red, crimson, alsike, white, and Japan; cowpea and soybean hays; and others of the legume family. They are all high in percentage of protein and lime and are very desirable feeds for dairy cows since they usually furnish protein, a necessary part of the ration, cheaply.

Non-legume dry roughage includes the native prairie hays, timothy, millet, cane, milo, sudan grass, fodders, corn stover (ears removed), and the various straws, such as wheat, rye, oats, and barley.

Succulent roughage includes all kinds of silage (Fig. 19) and root crops used for feed. Beets, turnips, and potatoes all fall in this class. A certain proportion of succulence in the ration of the dairy cow is believed to stimulate milk production.

Quantities to Feed.—Feeds vary widely in composition, and a ration that satisfactorily furnishes the nutrients needed by a cow must be carefully compounded. There are limits in quantity beyond which it is not desirable to feed or beyond which the cow will not ordinarily eat. In general, roughage is grown at home and is usually the cheapest part of the ration; efforts should be made to feed as much as possible. The quantity and quality of the milk, the weight of the cow, and the composition and palatability of the various feeds all affect the quantities that may be fed. Grain is ordinarily the most expensive part of the ration, so it is fed in the smallest quantities and directly in proportion to milk or butter-fat production. The following table will give some approximate relationships between different classes of feed.

FIG. 19.—Making silage is a good way to prepare for winter dairying.

A dairy cow will eat daily per 100 pounds of live weight the feeds shown below:

Hay, Fodders, Straws

2.5–3.8 lbs. alone.
1.5–2.5 lbs. with 3.0–4.5 lbs. silage.
1.8–3.0 lbs. with 3.5–6.0 lbs. roots or tubers.
1.5–2.5 lbs. with grain {1 lb. for each 3.0 lbs. milk produced or 7 lbs. for each 1 lb. butter-fat produced.
0.6–1.8 lbs. with 2.0–4.0 lbs. silage with grain as above.
0.6–1.8 lbs. with 2.5–5.0 lbs. roots or tubers with grain as above.
If fed alone, which is undesirable, silage should be fed 4.5–6.0 lbs. and roots and tubers, 5.5–7.5 lbs.

In general, 2.75 to 3.00 pounds of corn silage is considered equal in total nutrients (not protein) to one pound of good hay.

Concentrates.—For the high-producing dairy cow, the feeding of grain or concentrates is necessary if maximum production is to be obtained. Grains and concentrates include the cereals and other grains, and the by-products of milling and oil extraction. The practical method of using them is to make up a grain mixture that will furnish, with the roughage, a balanced ration.

A balanced ration is one that exactly meets the daily needs of the dairy cow, both for the maintenance of her body and the production of milk. In general, the problem of balancing a ration lies in furnishing the proper proportion of protein, carbohydrates, and fats.

Protein is needed by the animal to make blood, muscle, and milk and to carry on other body functions. It is vital to the continued health and to the milk production of the dairy cow and nothing can take its place. Lack of protein usually limits milk production. Protein includes a large number of highly complex substances, all of which contain the elements nitrogen, carbon, hydrogen, and oxygen and often phosphorus and sulfur.

Carbohydrates and fats supply energy (power to do work) and are needed by the cow to enable her to eat, walk, produce milk, and keep warm. Starches and sugars are typical carbo-hydrates. Fats are 2¼ times as valuable as carbohydrates; so fats are multiplied by 2¼ and added to the carbohydrates so that they may be considered together for their common purpose. Ordinarily a cow can eat enough of almost any kind of feed to supply her needs for energy, but protein must be supplied in larger proportions than it exists in many common feeds. Protein can take the place of carbohydrates in furnishing energy, but it is too expensive to be used for that purpose.

The simplest method of balancing a ration for dairy cows is to make up a grain mixture that when fed with the available roughage will supply enough protein, and ordinarily there will be enough carbohydrates and fat supplied. For this purpose the roughage is divided into three groups; (1) a high-protein group consisting of the legume hays; (2) a medium-protein group consisting of roughages one-half of which are legume hays, such as alfalfa and corn silage, or clover and timothy hay; and (3) a low-protein group consisting of roughages exclusive of the legumes. A grain mixture, to balance each of these roughages, must have a definite proportion of digestible protein. The following are suggested:

High-protein roughage	12 to 14%
Medium-protein roughage	14.5 to 17.5%
Low-protein roughage	18 to 22%

The first problem is to make up the cheapest grain mixture containing the proper percentage of protein, but other things must be considered.

Bulk is of importance, since bulky feeds appear to be more easily digested. One-half the grain mixture should be of bulky grains.

Palatability as a factor in feeding is frequently overlooked, but is of importance in dairy-cattle feeding if cows are to be made to produce their limit.

The physiological effect of feeds must be considered. A constipating or laxative feed must be so blended in a grain mixture or in a ration as to produce desirable results.

Lime and phosphates are required by dairy cows. The liberal use of alfalfa or other legume hays will usually supply the lime. For very heavy-producing cows or in regions of deficiency it is necessary to add odorless steam-bone meal to the grain mixture to supply phosphates. A proportion of one percent is enough.

Salt is needed by dairy cows, about 1 to 2 ounces each day. Salt blocks may be supplemented by the use of 1 per cent of salt in the grain mixture.

A Case in Balancing Rations.—Keeping in mind the requisites for a grain mixture, suppose it is necessary to balance a ration where the roughage is alfalfa hay. By reference to the table percentages of protein may be obtained. A high-protein roughage in the grain mixture may vary between 12 and 14 per cent. For example:

Quantity	Feed	Digestible Protein
lbs.		lbs.
100	corn meal	7.1
100	oats (ground)	9.7
100	bran (wheat)	12.5
100	linseed-oil meal	30.2
400	mixture	59.5

59.5 ÷ 400 = 1.48 or 14.8% protein

That is higher than necessary, so corn meal, the lowest in protein, is added as shown:

400 mixture	59.5
100 corn meal	7.1
500 mixture	66.6

66.6 ÷ 500 = .133 or 13.3% protein

Therefore a grain mixture to feed with alfalfa hay would be as follows:

Quantity	Feed	Digestible Protein
lbs.		lbs.
200	corn meal	14.2
100	oats (ground)	9.7
100	bran (wheat)	12.5
100	linseed meal	30.2
500	mixture	66.6
		13.3% protein

Such a grain mixture, fed with all the alfalfa hay the cow will eat in the proportion of one pound of grain to each 3 or 3½ pounds of milk produced or one pound of grain daily for each pound of butter-fat produced weekly, will give an approximately balanced ration.

The cost of protein or of total nutrients (protein+carbohydrates+2¼ x fat) may be determined by multiplying the coefficient for either (Appendix table) by the cost of 100 pounds of the feed. In the mixture given, bran and oats are bulky, corn is medium, and linseed meal is heavy; all ingredients are palatable; bran and linseed meal are laxative but with no succulent roughage may be desirable; alfalfa hay is high in lime, while linseed meal has both lime and phosphates and bran is high in phosphates. Providing the cost of such a mixture is reasonable, it is very satisfactory in other respects. Usually a better balance can be obtained if not less than three and preferably four grains or concentrates are included.

In making up grain mixtures (1) corn meal, hominy feed, milo grain, kafir grain and ground barley are interchangeable for all practical purposes; (2) wheat bran, middlings, and shorts are similarly interchangeable; (3) corn-oil cake, germ-oil meal, and cocoanut meal may be interchanged; (4) linseed meal, gluten meal, and cottonseed meal are fairly comparable.

Examples of grain mixtures for different classes of roughage are given below.

High-Protein Roughage—Digestible Protein in Grain 12 to 14 Per Cent

Mix. 1	Protein 13.32%	Digestible Protein	Mix. 2	Protein13.49%	Digestible Protein
lbs.		lbs.	lbs.		lbs.
200	corn meal	14.2	200	corn and cob meal	12.2
100	oats (ground)	9.7	200	oats (ground)	19.4
100	bran (wheat)	12.5	100	bran (wheat)	12.5
100	linseed meal	30.2	100	cottonseed meal	37.0
500	Mixture	66.6	600	Mixture	81.1

Medium-Protein Roughage—Digestible Protein in Grain 14.5 to 17.5 Per Cent

Mix. 3	Protein 16.57%	Digestible Protein	Mix. 4	Protein 16.58%	Digestible Protein
lbs.		lbs.	lbs.		lbs.
100	corn meal	7.1	100	corn and cob meal	6.1
100	oats (ground)	9.7	100	oats (ground)	9.7
100	bran (wheat)	12.5	200	bran (wheat)	25.0
150	linseed-oil meal	45.3	125	cottonseed meal	46.25
450	Mixture	74.6	525	Mixture	87.05

Low-Protein Roughage

Mix. 5	Protein 19.09%	Digestible Protein	Mix. 6	Protein 18.96%	Digestible Protein
lbs.		lbs.	lbs.		lbs.
100	corn meal	7.1	100	corn and cob meal	6.1
100	oats (ground)	9.7	100	oats (ground)	9.7
200	bran (wheat)	25.0	250	bran (wheat)	31.25
150	linseed meal	45.3	100	linseed meal	30.2
100	cottonseed meal	37.0	150	cottonseed meal	55.5
650	Mixture	124.1	700	Mixture	132.75

The quantity of cottonseed and linseed meal must be limited so that neither forms more than one-fourth of the grain mixture.

Accurate Balancing of Rations.—For the accurate balancing of rations the total nutrients in addition to the protein must be considered. If balancing for a herd, the use of the average in weight and milk production will prove satisfactory.

Morrison's Feeding Standard[1]*—Nutrients Needed*

	Digestible Protein	Total Digestible Nutrients
	lbs. Average	lbs. Average
Maintenance for 1000-lb. cow[2]	0.700	7.925
Maintenance for each 100 lbs. live weight	0.070	0.7925
For each 1 lb. of 3.0% milk	0.052	0.271
For each 1 lb. of 3.5% milk	0.055	0.300
For each 1 lb. of 4.0% milk	0.059	0.328
For each 1 lb. of 4.5% milk	0.063	0.357
For each 1 lb. of 5.0% milk	0.066	0.382
For each 1 lb. of 5.5% milk	0.070	0.406
For each 1 lb. of 6.0% milk	0.074	0.431

[1] Morrison's Feeding Standard was devised by F. B. Morrison of the Wisconsin Station and is published in "Feeds and Feeding" by Henry and Morrison.

[2] Maintenance is the quantity of nutrients needed daily to keep the animal alive and functioning properly at the same weight without doing any work or putting on flesh.

To balance a ration accurately either obtain the weight of the individual cow or determine the average weight of the herd. Then calculate the digestible protein and total nutrients needed for an animal of that weight for maintenance. Calculate the protein and total nutrients needed for milk production and add to the maintenance, and the total is the daily requirement for a cow of the given weight producing the given quantity of milk. (See Appendix for feeding tables.)

Example.—Given a 1200-pound cow producing 35 pounds of 4-percent milk daily, with mixed clover and timothy hay, corn silage, corn meal, ground oats, wheat bran, and linseed meal available for feeding. From Morrison's feeding standard the following is found:

	Digestible Protein lbs.	Total Digestible Nutrients lbs.
1200-lb. cow maintenance	0.840	9.510
35 lbs. 4% milk	2.065	11.480
Total requirement for one day	2.905	20.990
40 lbs. corn silage	0.440	7.080
12 lbs. clover and timothy hay	0.480	5.544
Total supplied by roughage	0.920	12.624
Nutrients to be supplied by grain	1.985	8.366
Take 11 lbs. of mixture 3	1.823	8.063
Nutrients lacking	0.162	0.303
1 lb. mixture 3	0.165	0.733
Excess nutrients	+0.003	0.430

Feeding of Heavy-Milking Cows.—General Suggestions.— The larger the milk production, the greater the skill required to feed a dairy cow efficiently. Above all others, two facts must be known, the weight of the cow and the production of milk. Without these facts, feeding is pure guess-work. Careful watching of the cow's appetite, her coat conditions, and the consistency of her manure is necessary for skilful feeding. Manure should be of rather soft consistency, the cows ears' should be warm and her muzzle moist, and her coat should be soft and oily to the touch. Any departure from these conditions, such as a harsh feel to her hide, indicates that something is out of order. Constant observation and care is the price of good feeding. A heavy-milking cow should be encouraged to eat all the hay possible, and silage is usually fed at the rate of 2½ to 3 times the hay. Then feed grain in proportion to milk yield, 1 pound to each 3 or 3½ pounds of milk produced. If the cow produces more milk, increase the grain; if she produces less, decrease the grain. For three months after freshening the cow usually loses weight and during this period draws on her body store. After that time she should gain slightly each month, especially after breeding. Chopped roots are very useful for feeding cows, especially those of high production, since they help digestion. Cows should be dry about six weeks before freshening. During the dry period they should be well fed so that they can milk from their stored-up flesh for the first two or three months. When cows are fed less than their requirements they usually produce less at the succeeding milking period.

Water.—Milk is seven-eighths water, and the production should not be limited by lack of fresh pure water.

The herd bull may be fed the same grain mixture as the cows receive, together with hay and a little silage. Too much hay is undesirable as it tends to "slow up" a bull, and only a limited amount of silage, not over 20 pounds, should be fed. Enough grain should be given to maintain the bull in moderate flesh, which will require a proportion varying between 1 pound to 250 pounds of live weight and one pound to 350 pounds of live weight. Exercise and plenty of pasture are necessary for a vigorous active bull.

Job 7. Caring for and Managing the Herd

Conditions Usually Found.—(1) Many dairy herds are so carelessly managed that they are less profitable than they should be. (2) Thoughtlessness is often the parent of careless management.

Aims.—Dairymen should become familiar with the principles as well as details of dairy herd management.

Problems for Study and Discussion.—(1) Find how many cows in your region freshen in the fall; how many in the spring.

2. Give reasons for changing to fall freshening.
3. Ask dairymen to describe how they change cows to the fall basis.
4. Get dairymen to describe how they dry-off cows. Find the best points in their plans.
5. Ask farmers under what conditions they milk cows before freshening.
6. Study the chore systems on several farms and compare them with the system given in these pages.
7. Find how many dairymen place names or numbers of their cows over the stalls.
8. How are cows prevented from kicking?
9. What devices are used to prevent cows from sucking themselves?
10. What methods do you find for providing exercise for bulls in summer? In winter?
11. What dairymen allow the herd sire to run with the cows?
12. Give reasons for and against this plan.

Activities.—(1) Assist in ringing a bull. (2) Show a milker how to manage a kicking cow. (3) On a chart write a chore program for winter for your farm.

Breeding.—It is good practice to have a cow drop a calf every year. Following such a practice, her milking period will be from about ten to ten and a half months and she will be dry the remainder of the year. The maximum production cannot be obtained by this method for a single lactation period, but year in and year out it will give the best results for the average herd. The average gestation period is about 282 or 283 days. To have fall and early-winter calves dropped, cows must be bred between December first and April first. (See Job 9, beef enterprise.) The œstrum, or period of heat, occurs on the average every twenty days and lasts from twelve to forty-eight hours. This is the only period in which the normal cow can be bred. Only one service should be allowed, and a bull should not be allowed to run with the herd since it is then impossible to keep a record of the services and it is not good for the bull or for the cows.

Fall Freshening.—Cows produce most during the first few months after freshening. If they freshen in the fall the greatest production will come when milk and butter-fat bring a higher price. Good dairy cows will keep up a heavy milk flow during the entire winter. A slackening in milk flow naturally comes after four to seven months of production. If succulent pastures and warm spring weather come after this time the members of the herd should be greatly stimulated again. Some dairymen call this a "second freshening" of the cows. The dry summer season comes at a time when fall-freshened cows should naturally be declining in milk flow. Their rest period may be given then.

Statistics have shown that cows freshening in the fall yield much more milk during their milk period than cows freshening in the spring. Dairymen can hardly afford to overlook this fact.

Labor required for the care of calves is more available in the winter. Fall freshening means more winter dairying, and more barnyard manure is produced at a time when it can be saved.

Fall Calves.—All dairy calves must be given whole milk and skimmed milk as their main feed for several months. Their first chief supplement for this feed is grain in some form. Fall calves are ready for pasture when the pastures are green in the spring. Where winters are very long, calves should be dropped in December or January. Fall-born animals freshen in the fall at two years of age and thus fit into the herd routine.

Planning for the Fall Basis.—It is difficult to change the whole herd to the fall basis at one time, but a plan should be made for each cow separately. As the milk period of a cow is usually only ten or ten and a half months, the freshening period may be backed up one or two months each year until the fall plan of freshening is reached. This plan, however, is impossible with cows which fail to breed soon enough after freshening to pursue the backing-up plan. As such cows are persistent milkers, their breeding period may be moved forward instead and the fall plan can be reached.

Drying-Off.—To reach the fall basis of calving it is often necessary to hasten the drying-off period if the cow is to be given some rest before the next calf comes. Drying-off is also necessary each year with persistent milkers. There are several factors involved in this process: (1) withholding grain; (2) leaving a little milk in the udder each time; (3) milking only once a day.

Managing the Dry Cow.—Remember this cow is soon to be your heavy producer. She should be given feed which will cause her to lay on some flesh and cause her to rest without being in a nervous, hungry condition at any time. Good pastures may suffice, but grain is usually necessary. Individual attention to each cow is a good guide to her needs.

Feed given to her at this time will be returned after she freshens, in the milk pail and the butter-fat supply.

Milking.—For the sake of cleanliness, milking should always be done with clean, dry hands. Wet-hand milking is filthy and is likely to spoil the shape of the udder and teats. One of the best and most efficient methods of milking is to grasp the teat or as much as possible with the full hand and then squeeze, beginning at the top and squeezing down, milking opposite quarters or diagonally opposite quarters at the same time. Stripping as a method of milking is not to be recommended; it is hard on the udder and likely to result in dirty milk. A young cow can usually be trained to let down her milk promptly, which will shorten the time of milking. Do not spend too much time stripping the last milk from the udder.

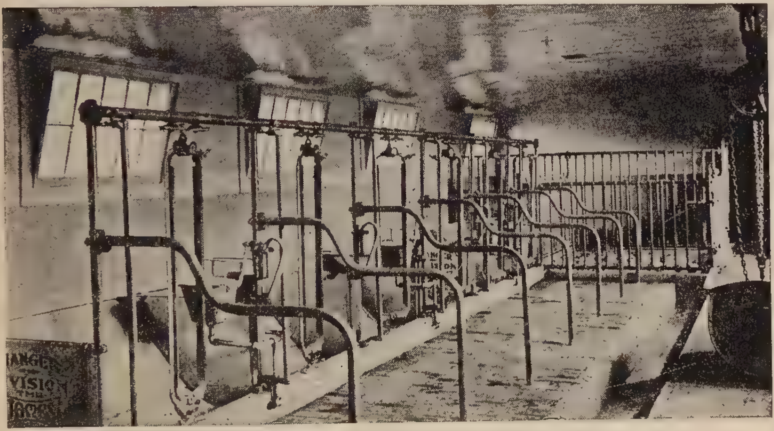


Fig. 20.—A convenient barn aids in good management. Note the calf stall, manure gutter, feed manger, stanchions, and watering cups.

In common practice, cows are milked twice daily at approximate twelve-hour intervals. In general, however, up to four times daily, the more frequently a cow is milked the larger will be her milk flow. The increase in the quantity of milk produced for three times a day over twice a day varies from 15 to 45 per cent. The increased production from milking four times a day over milking twice a day varies from 25 to 125 per cent. In advanced-registry testing, it is quite common to milk cows three or four times daily.

Kicking of cows is usually the result of bad treatment. Quiet gentle methods will help. Sore teats should be cured to prevent irritation. A soft rope tied about the hocks during milking, in the form of a figure eight, may be necessary for habitual kickers. Break a cow of sucking herself by putting a ring in her nose and hanging on it other rings or a baffle board.

Details of Management.—In planning the operation of a dairy (Fig. 20) it is necessary to arrange for a regular routine. The order of doing work depends upon the conditions. The following is given merely as an example.

In Winter

Before Breakfast

- Feed grain
- Clean cows, wipe udders
- Milk
- Turn cows out for water

After Breakfast

- Clean stable and bed down
- Wash utensils
- Mix grain
- Put cows in barn
- Get down hay and silage and feed
- Attend to sick cows
- Miscellaneous

After Dinner

- Prepare everything for milking
- Turn out cows for water
- Bring in cows
- Clean cows, wipe udders
- Feed grain
- Milk
- Feed silage

After Supper

- Feed hay
- Arrange bedding for night

In Summer

Before Breakfast

- Bring cows into barn
- Feed grain
- Clean cows, wipe udders
- Milk
- Turn cows out to pasture

After Breakfast

- Clean stable
- Wash utensils
- Mix grain
- Attend to sick cows
- Miscellaneous

After Dinner

- Prepare everything for milking
- Bring in cows
- Clean cows, wipe udders
- Feed grain
- Milk
- Turn out cows

Hints to Dairymen.—Avoid keeping dogs around dairy cattle. Give plenty of fresh water two or three times daily: never have it very cold in the winter. Change the ration gradually, never suddenly. Feed hay after milking; not before or during the milking, because of dust. Name the cows and keep their numbers and names posted over their stalls.

Managing the Manure.—In the winter season, manure from the dairy barn should be managed carefully for two reasons; the barn must be kept clean and the manure is worth saving. When weather will permit, manure should be hauled daily or frequently to fields and spread at the time of hauling. The soil of the field will absorb the plant food of the manure more readily than any other material. Another good plan is to have the manure placed daily in a covered shed a few rods from the barn. This may be done with a litter carrier running on a track (Fig. 20) or by a wheelbarrow or truck. Manure from the shed may be hauled as time and conditions will permit. This should be done before flies begin to breed in it.

It is a poor plan to throw manure from the barn with a fork. It should not be allowed to leach in the barnyard or under the eaves.

The barn is kept more sanitary and the manure is saved better when plenty of good bedding is used. The cows are more comfortable with plenty of clean bedding.

Job 8. Improving the Herd. Keeping Records

Conditions Usually Found.—(1) Cow-testing associations and other forms of testing are found in many dairy sections. (2) Systematic culling and improving of herds is too often neglected by dairymen.

Aims.—Students should understand how to cull herds, how to keep and use production records, and how otherwise to improve herds.

Problems for Study and Discussion.—(1) How many local dairymen weigh and test milk from individual cows regularly?

2. Get opinions of others regarding this.
3. Describe the operation of a cow-testing association.
4. If you were a testing official in such an association what would be your duties?
5. What is a herd record book?
6. What is meant by the feed cost of 100 pounds of milk? Of a pound of butter-fat?
7. What is meant by advanced registry of cows?
9. What breed association calls this "registry of merit"?
10. Why should the milk and butter-fat production of the dam of a bull be known before you buy him?
11. How can a community improve the herds by coöperative ownership of a good bull?
12. How can a dairyman prove that he is using a good bull in his herd?
13. When should a dairyman practise selecting or culling his cows?
14. How can type or conformation be used in culling?
15. What records should be kept by all dairymen beside those of individual cows?

Activities.—(1) For a month or more keep daily records of milk from a herd. (2) Test samples from each cow by the Babcock method. (3) Calculate the butter-fat income from each cow in the herd for a month and find the value at local prices. (4) Draw up agreements and rules for a local neighborhood-bull association. (5) Draw up rules and regulations for a local cow-testing association. (6) Draw forms for keeping a labor record for a dairy herd for one year and fill this form in part with data from a good dairyman. (7) Draw a form for keeping a feed record by months for a dairy herd. (8) Draw a form for keeping a herd sales record to suit your business.

A herd book, containing the information about each animal, including its description, birth date, pedigree, calving dates, and milk production, is absolutely necessary in keeping a pure-bred herd, and is useful with any herd. A cow-testing-association record sheet or one of similar design is useful for determining profit and loss.

Labor Record.—Every dairyman should keep a monthly record of three kinds of labor chargeable to the dairy business: hired labor, self-labor, and horse labor. (See beef enterprise.)

Miscellaneous Expense Record.—A record of miscellaneous expenses should include repair materials, insurance, interest, rent, taxes, depreciation on equipment, veterinary costs, and medicine.

Feed Records.—Weekly or monthly feed records should be kept for calves, dry stock and milk cows. A form for a calf-feeding record is here shown. Feed for cows may be kept on the form shown.

CALF-FEEDING RECORD

Form of.......................... Week beginning.............. 19....

No. of Calf	Day of Month	Mon.		Tues.		Wed.		Thur.		Fri.		Sat.		Sun.		Total
	Feeds	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	M.	E.	
	Whole milk. .															
	Skim-milk. . .															
	Grain.															
	Hay.															
	Silage.															

Barn Record.—A record should be kept of all services, births of calves, feed received, and other articles received at the barn. A card form may be used as follows:

Daily Barn Report

BREEDING RECORD

..............................bred to..............................
..............................bred to..............................
..............................bred to..............................

BIRTH RECORD

........lb...........calf from................by......................
........lb...........calf from................by......................

FEED RECEIVED

..........lbs....................................from...............
..........lbs....................................from...............
..........lbs....................................from...............

OTHER ARTICLES RECEIVED

....
....

A summary of these data should be made at the end of each week or month. Forms for bull services and births of calves are shown below.

Bull Services						Cows Calved			
Date	No. of Cow	No. of Bull	Date	No. of Cow	No. of Bull	Date	No. of Cow	Sex of Calf	No. of Calf

Sales and Credits.—A record of all the items to be credited to the dairy business should include sales of milk products entered at definite intervals, sales of livestock, and credits for manure for the year.

Milk Disposal Record.—In dairies the milk or cream produced is disposed of in different ways and the amounts vary from day to day. A record should be kept. The form is enough for a week at a time.

FARM OF.................................WEEK BEGINNING..................19....

									TOTAL
Day of month									
On hand from previous day									
Milk Produced	Morning								
	Evening								
	Total								
Disposal of Milk	To calves								
	Sold to employees								
	Separated								
	Sold								
	Sold								
	Total								
	Carried over								
On hand from previous day									
Cream made									
Disposal of Cream	Sold to employees								
	Churned								
	Sold								
	Sold								
	Total								
	Carried over								
Disposal of Skim-Milk	To calves								
	To hogs								
	Sold								
	Total								
	Carried over								

Inventory.—At least once a year an inventory should be taken of all livestock and dairy equipment, and values should be assigned to each item. A comparison of inventories at beginning and end of month or year helps to show the condition of the business. The form here shown is suitable for a dairy livestock inventory.

CATTLE ON HAND AT END OF MONTH OR YEAR

DATE..................19....

Cows in milk....	Young stock, 6 months to 2 years.	Bulls.....	Calves under 6 months.	Bulls.....	Females due to freshen in 4 weeks.	....
Bulls...........		Heifers...		Heifers....		

Selecting or Culling.—Cows are in a dairy herd for a useful period of about five to seven years after they first freshen. After this, cows may be sold for dairy purposes or for beef, according to their age, future usefulness, and other factors. Replacements must be planned for each year to make up for the cows that are becoming old and unprofitable or are removed for other purposes. The number of animals replaced each year depends upon a number of things, such as the regular breeding of the cows; but perhaps the most important is the milk and butter-fat production of the cows. With better young cows coming on, the older and less profitable ones are sold. In practice it is well to have the average age of the herd as young as possible.

Weighing Milk.—To determine the production of a cow it is necessary to weigh her milk at regular intervals. It is very easy and takes little time to weigh and record each milking, especially with a spring balance with an adjustable hand that balances the pail and thus allows direct reading. Weights are recorded upon a milk sheet upon which are columns for each cow with divisions marked for milkings and days for a month. Weighing milk is a quicker, more accurate, and more convenient method of determining the quantity of milk produced than measuring (Fig. 21).

Testing Milk for Fat.—The value of milk is determined to a very large degree by the butter-fat contained. It is necessary, therefore, that the percentage of butter-fat be determined. This may be done by the Babcock test. If the milk of each milking for one day or a true composite of such milk is tested once a month, then the quantity of butter-fat produced for the month may be determined by multiplying the total milk production, obtained by weighing the milk at each milking, by the percentage of butter-fat obtained for the one day. A fairly accurate method is to weigh each milking for one day and to test the milk for butter-fat for that day. After figuring the quantity of butter-fat produced, multiply the result by the number of days in the month. 25 (pounds milk) x 4.0 (per cent butter-fat) = 1.0 (pounds of butter-fat for one day) x 30 = 30 (pounds of butter-fat for one month).

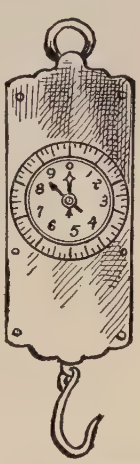


FIG. 21.—Milk scales with an extra movable red pointer which may be adjusted to balance the weight of the empty pail.

The butter-fat production of a cow is a more accurate method of determining her worth than her milk production, and it permits a fair comparison of high-testing cows with low-testing cows.

Production Records.—With records of cows for a year showing their production of milk and butter-fat it is easy to determine which cows are the highest producers and thus to select the better ones for retention in the herd, and to dispose of the lower producers. Year after year in this way constant selection must be practised if the herd is to improve steadily in average production. The higher-producing cows, mated with a bull whose ancestors indicate high producing ability, should produce daughters that yield better than their dams. By careful following of these principles the production of the herd can be increased year by year. The higher the average production of milk and butter-fat per cow, the more difficult will be continued improvement, and the more carefully must the cows and bull be selected.

Cow-Testing Associations.—Many farmers who desire records of their cows feel that they do not have the time to keep them. They therefore get together in groups of from 26 to 30 and form a cow-testing association. This is a coöperative organization which employs a dairy-trained man, who visits each farm for one day each month, and weighs and tests each cow's milk and weighs her feed.

On the basis of one day's figures the milk and butter-fat production of the month is calculated and the feed consumption is figured. The feed cost of a hundred pounds of milk and of one pound of butter-fat and the returns for a dollar spent for feed are determined. Cow-testing-association records furnish the farmer with a record system for his cows so that the profit or loss may easily be determined, since it is commonly considered that the calf and the manure pay for the bedding, labor and other charges. (Get forms from your experiment station). The cow-testing association does not do anything that the farmer cannot do for himself, but it does keep his records in a businesslike manner.

Cows leading in monthly records are listed in local papers. Herds reaching certain standards may be certified and the results published. These features aid in the sale of male calves and other stock.

Advanced Registry.—Each breed of dairy cattle has an advanced register, register of merit, or register of production, in which is recorded the names and records by ages and classes of the pure-bred cows of the breed that produce in excess of a minimum requirement. Bulls that have from two to four daughters that have met the requirements are also listed. The advanced registry provides an official production record of cows, enables pure-bred breeders to measure their cows with those of others, and provides a means of selection based on production. Advanced registry tests are conducted in the United States under the supervision of the several state experiment stations, and every effort is made to insure the accuracy of the records.

In brief, the method is to have a supervisor visit the farm for one or two days each month. During his visit he is present at each milking and weighs the milk from each cow. Each milking is tested in duplicate by the Babcock test, a true average percentage of butter-fat for the period —one or two days—is determined, and the test report is sent to the official in charge in the state. This test is made each month, and the length of the record may be for ten months or a year. There are minimum requirements that must be met for butter-fat and sometimes for milk.

The Holstein-Friesian Association of America also recognizes shorter tests for 7 days, 30 days, 60 days, 90 days and 120 days, providing the supervisor is at the owner's farm conducting the test for the entire time. The owner must weigh the milk at each milking and submit the record monthly to the breed registry association. There the total butter-fat production for the month is calculated, using the average percentage obtained from the supervisor's one- or two-day report.

The advanced-registry system furnishes an accurate record of the cow under the supervision of disinterested authorities. The cost of the supervisor's salary and expenses, a small fee for the college, and a fee for the herd-registry association must be paid by the owner. This makes an advanced-registry record much more costly than the cow-testing association. It is different from the cow-testing association in that there is no effort made to determine anything but the production of the cow.

Type.—Good conformation or type is not so important as production, for a dairy cow must be a producer to serve her purpose. It is, however, important, especially when sales of livestock are to be made. Fundamentally, type is a combination of utility with beauty. For example, a straight back is probably stronger than one that sags, and it certainly is more attractive. Straight top lines on animals, especially level rumps, are features that cattle buyers desire. Pendulous udders are likely to cause trouble by being stepped on, and efforts should be made to select animals that do not have this fault. Long-attached, even-quartered udders with evenly-placed and uniform-sized teats, are a feature to be considered. A great deviation from the accepted type for the breed is likely to give the animal a lower sale value, especially in the case of a pure-bred.

Young bulls that are rough in conformation are sold at much lower prices than those of more perfect type. The most saleable cow is the profitable producer with attractive appearance.

Community Herd Bull.—Always use in a dairy herd a sire from a high-producing mother. A dairyman can prove the value of the sire by testing the production of his heifers and comparing them with their mothers at corresponding ages. Community breeding associations are often formed for the ownership of valuable sires. Such an association can afford to buy a much better animal than can an individual dairyman. The herds of all the members will thus be improved and the cost for each will be very slight. All the members become interested in improving their herds and will compare results. Keen rivalry may be maintained. Members will cull their cows more closely. A small association is usually better than a large one. All must be careful to avoid introducing disease or spreading disease from one herd to another.

Job 9. Controlling Diseases and Enemies

Conditions Usually Found.—(1) Dairy farms have considerable loss from cattle diseases. (2) Many of them employ experts to test for tuberculosis and to advise them in controlling all diseases which occur in their herds.

Aims.—(1) Students should learn the treatment of common troubles of dairy cattle. (2) They should know when it is best to call in experts.

Problems for Study and Discussion.—(1) Ask dairymen what diseases are most prevalent.

2. Find what treatments they use for the common diseases.
3. What local farmers have had cattle tested for tuberculosis?
4. How many milk cows of your region probably have this disease?
5. How could you have a herd accredited? What does this mean?
6. What is the value of a campaign to eradicate tuberculosis from the county?
7. Describe a case of garget or inflamed udder.
8. What home remedies are used for this?
9. How would you treat a case of bloat?
10. Give directions for the care of cows' feet.
11. What farmers have had trouble with infectious abortion of cattle?
12. How have they eradicated it?
13. Describe a case of milk fever and tell how to treat it.
14. Describe lumpy jaw.
15. Describe chapped teats and tell how to treat them.
16. How would you control bad warts?
17. Give the symptoms of cow-pox and the treatment.

Activities.—(1) Assist in testing a herd for tuberculosis. (2) Assist in treating a cow for milk fever. (3) Assist in treating a cow for bloat. (4) Try to become skilful in drenching a cow safely.

Milk fever is commonly found among cows giving large quantities of milk. The sure symptoms of the disease are to find the cow reclining on her breast-bone with her head thrown sleepily around toward her right side, her nose pointing to the pain in her udder. Early symptoms are restlessness and feverish condition, followed by a staggering walk. In the latest stages the cow lies stretched out in a condition of bloat.

Relief from a milk fever attack can usually be brought about by pumping air into the udder. Frequently in two hours time the cow will be recovered and be up and walking around the premises.

The pumping of the air into the udder can best be accomplished by means of a milk-fever outfit, consisting of syringe for pumping the air, a tube of medicated cotton to sterilize the air going through it, and a milk tube to insert into the teat. Care should be taken that the instruments are sterile, as an infection within the udder may otherwise result.

Tuberculosis.—Health in the herd is essential for profit. A high-producing herd is useless unless its members have good health. Tuberculosis, one of the great cattle menaces, is now being controlled and eradicated by the elimination of infected animals through the operation of the tuberculin test. For self-protection all animals purchased should have passed that test and it should be administered each year to the entire herd by a competent veterinarian. All reacting animals should be slaughtered. In this way, it is possible to have a herd free from this disease and to keep it free. Herds regularly tested and passed as free for a certain length of time are called *accredited* under regulations issued by the state and federal authorities. County clean-up campaigns have been successfully carried out in many counties. (See also job 10 in beef enterprise.)

Contagious or infectious abortion is a disease that causes a tremendous economic loss both from loss of calves and from reduced milk-production of cows. In purchasing animals, if possible select only from herds proven by the agglutination test to be free from the disease. As a method of prevention of the spread of the disease, quarantining all cows for two weeks before and 60 days after freshening is useful, together with keeping all calves and heifers separated from the herd cows. All litter and waste feed from the stalls used at calving and for quarantine should be burned, as it is infectious. Sanitation and isolation are useful in keeping down this disease, which causes the greatest loss of all diseases affecting dairy cattle. (See Job 10 in beef enterprise.)

Various ailments occur in the herd from time to time, including cow-pox, hoof-rot, and inflammation of the udder. Each tends to reduce the milk yield and thus cause loss.

Cow-pox is an infectious disease that will rapidly spread from one cow to the other. Any cow afflicted with the little blisters or pustules should be separated from the rest of the herd and milked last to prevent the spread of the disease to other cows. The sore teats should be washed with a solution made up of one-half ounce of hyposulfite of soda dissolved in one pint of water. After milking an infected cow, the milker should carefully wash his hands.

Hoof-rot, evidenced by limping, soreness, and swelling between the hoofs, is treated by cleaning out the hoof and washing it with carbolic acid or compound solution of creosote, one ounce to a pint of water. Afterwards the animal should be kept in a clean, dry place until the hoof is normal.

Inflammation of the udder is evidenced by a hardness or congestion of the udder and general disturbances of the health. Hot applications (cloths wrung out in hot water) applied to the udder, rubbing the udder with camphorated oil, and a drench of one pound of epsom salts, given internally, are helpful. A drench of 2 tablespoons of formalin in a quart of milk is frequently useful.

Garget occurs just before or soon after calving. It is more common in heavy milkers than in others. Often the udder is enlarged, hot, and tender to touch. Garget is caused by feverish congestion of tissues. Cold cement floors and cold drafts of air may cause or aggravate the trouble. Incomplete milking may bring on this trouble at almost any time in the milk period. Sometimes the milk is tinged with streaks of blood. It is likely to be stringy and clotted, and is unfit for use. One quarter or one side of the udder may be affected and the remainder still healthy.

Place the cow in a clean, dry, well-bedded stall. Manipulate the udder lightly with the fingers. Apply hot, wet towels to the affected parts to restore circulation. Apply turpentine and lard or camphorated oil. Rub the lotion in well. Repeat this often. Milk the udder, and particularly this quarter, very dry four times a day. If the bowels are sluggish, drench the cow with a pound of epsom salts in water.

Bloat in cows may be caused in several ways: (1) feeding heavily on green pasturage when animals are not used to it; (2) impaction of the rumen; (3) feeding on spoiled or fermented feed; (4) indigestion.

In the first or true form of bloat, called *hoven*, the feed taken into the stomach causes abundant gas formation which inflates the body, causing intense nervousness and pain. This is easily recognized by the left side bulging upward and outward, being tight as a drum. The animal may lie down or fall.

If the case is mild, continued exercise by driving or massaging the body with the hands may relieve the distress. Tying a piece of fork handle or heavy rope smeared with tar in the mouth of the animal like a bridle bit will cause the animal to work the tongue and muscles of the throat enough to allow much gas to escape. Salt or soda thrown into the mouth may help.

Some cases are too severe for these mild treatments. In such cases it may be necessary to relieve the gas fermentation by puncturing the body wall. The incision through the skin and body wall is made forward and downward at the center of the triangle formed by the hook bone and the last rib on the left side. Use a trocar (a sharp-pointed instrument), but if such is not available make a small incision with a sharp knife. Then insert a tube and allow the gas to escape. Give the animal a dose of salts to help remove the fermenting materials. After the trouble is over, disinfect the wound. This form of bloat is not uncommon in herds and preparation should be made to treat it without outside help.

Impaction of Rumen.—Cattle feeding on dry straw or corn stalks without frequent drinking may be affected with impaction. The animals become logy and dull, and there is no passage of manure. A large dose of epsom salts should be given and this should be repeated if the first dose is not effective in a reasonable time. If this treatment is not effective a veterinarian should be called. (See Job 5).

Chapped Teats.—Cows with suckling calves, and sometimes others, are often troubled with chapped teats, particularly in the winter season. Cold, damp stalls and cold winds are likely to cause or increase chapping. It often causes severe swelling and great soreness. Milk flow is often reduced.

Remedy any cause which can be detected. Avoid irritation at milking time. Soften the wound with vaseline. In the early stages use collodion on the wound in a thin flexible layer. The use of alum may harden the tissues and produce some improvement.

Warts.—Large tumors or warts on various parts of the body often become very troublesome. Treat them in the early stage with pure olive oil, smeared on frequently, as after each milking. If they become larger and persistent they may be removed by cutting, which operation should be performed by a veterinarian.

Lumpy jaw is believed to be a fungous disease affecting the bone and adjacent tissues of the under jaw of a cow. The disease is not common, but is very severe and easily recognized when present. When only the muscles and soft tissues are affected the disease yields to treatment, but when the bones are severely attacked treatment is practically useless. Potassium iodide dissolved in water and administered as a drench once a day in the early stages of the disease is very beneficial. Continue the drenching until iodine poisoning begins to set in. Advanced cases should be treated by an expert.

Care of Feet.—There are various odd jobs around a dairy herd that must be attended to from time to time. One of the most important, in sections where there is little gravel or rock, is trimming the animals' hoofs. This may be done by means of a wood chisel with a long handle, and a wooden mallet, standing the animal on a wooden block or floor and chipping the hoof; or by means of nippers and a hoof knife. Long hoofs will often cause permanent lameness. To use a hoof knife, it may be necessary to throw an animal.

Throwing cows may be accomplished by attaching a long, strong rope around the cow's neck in a solid noose, passing it back over the withers and making a circle of the animal just back of the fore legs so that pulling will tighten the loop. Then passing back to the region just in front of the hind legs, make another loop that will tighten when pulled. The animal is then held or tied by means of a halter and several persons pull back on the long rope. This tightens the two loops and paralyzes the muscles so that the animal falls. Then her feet should be tied and her head held so that she will not struggle.

Other Trouble.—In Job 10 of the beef enterprise the student of dairying will find valuable discussions of Texas fever, foot-and-mouth disease, warbles, lice, drenching, dehorning, and castration.

When in doubt as to what to do, consult a local veterinarian. As a measure of preserving health, keep dairy cattle out of doors as much as weather will permit. Housing of cattle is unnatural and tends to bring on disease.

Job 10. Testing for Butter-Fat

Conditions Usually Found.—(1) Many farms now have a cream separator and separate the milk at home. (2) Cream is sold on its butter-fat content as determined by the Babcock test. (3) The method of conducting a Babcock test and the cause of variations in butter-fat should be known to those selling dairy products.

Aims.—The proper methods of conducting tests for butter-fat in dairy products and the causes of variations in butter-fat percentage in milk and cream should be thoroughly understood.

Problems for Study and Discussion.—(1) Why is it necessary to have a quick and accurate test for butter-fat in dairy products?

2. Explain the principles of the Babcock test.
3. How are these principles used in everyday life for other purposes?
4. Describe in detail how to conduct a Babcock test for milk; for cream; for skim-milk.
5. Describe a method of taking samples.
6. Explain why it is necessary to take composite samples rather than to dip samples of several lots of milk that are to be tested.
7. Explain reasons for the cream test varying.

Activities.—(1) Practise testing various milk products, such as whole milk, cream, skim-milk, butter, and cheese, by the Babcock methods.

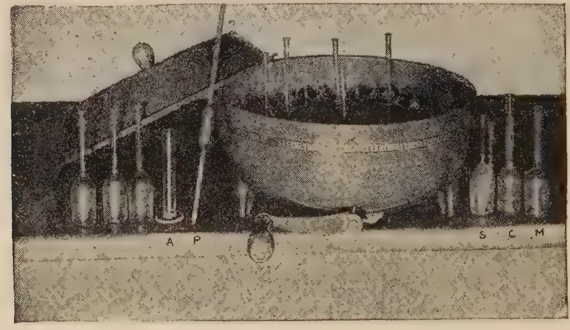


Fig. 22.—Glassware and centrifuge for making Babcock test for butter-fat in milk, cream, and skim-milk. (Wis. Sta.)

Babcock Test for Butter-Fat.—Butter-Fat Variations.—The butter-fat content is the basis upon which milk and cream are commercially purchased, and to a considerable degree is the basis for the selling price of dairy products. The necessity for a rapid yet accurate test for butter-fat in dairy products is therefore evident. For years, various inaccurate and cumbersome tests were used, but in 1890 S. M. Babcock, chief chemist of the Wisconsin Station, finally devised, patented, and gave free to the world the Babcock test. (Figs. 22 and 23.)

Principles.—Essentially, the method consists of measuring or weighing a definite weight of the dairy product into an especially graduated bottle, then adding commercial sulfuric acid (H_2SO_4—specific gravity 1.82–1.83) and mixing thoroughly the contents. The bottle and contents are then whirled or centrifuged three times, hot water being added after the first two whirlings, and at the completion of the final whirling the percentage of butter-fat is read directly with dividers on the graduated column of the neck.

The principles involved are that sulfuric acid will first curdle and then dissolve or digest the curd of milk, freeing the butter-fat. The heat that is generated from the action of the acid on the water and milk solids melts the butter-fat and thus helps free it from other constituents. The difference in the weight or specific gravity of the different ingredients (water—1.0, acid—1.83, milk serum—1.036, and fat—.93) tends to cause a separation of the fat, and this is hastened and made more complete by the action of centrifugal force, since in whirling the bottles are in a horizontal position. The heavier material goes to the bottom and the lighter fat is forced to the top of the bottle, where the addition of water forces it into the graduated neck for reading.

Fig. 23.—Testing milk of each cow to compute the fat. (U. S. Dept. Agr.)

Equipment for Whole Milk Testing.—(1) Centrifuge or Babcock tester, hand, steam, or electric, in which the tests are whirled.

2. Sample jars,—any size with tight covers, but 4-ounce size with screw covers are convenient.
3. Milk-test bottles—with 8 per cent or 10 per cent graduation on the neck.
4. Milk pipette—17.6 cubic centimeters (c.c.) capacity, for measuring milk.
5. Acid measure or dipper—17.5 c.c. capacity, for measuring sulfuric acid.
6. Thermometer—floating dairy type with graduations from 0 to 220 degrees F.
7. Dividers or calipers for measuring the fat column.
8. Sulfuric acid (commercial) sp. gr. 1.82 to 1.83.
9. Water bath—any vessel for holding hot water.
10. Washing powder.
11. Test-bottle brush.

Additional Equipment for Cream Testing.—(1) Cream-test bottles—9-gram 50 per cent size.

2. Cream-test balance or scale—a scale sensitive to 25 milligrams (.025 grams) for weighing cream samples.

3. Weight—a 9-gram weight tested for accuracy.

4. Pipette—9 c.c. for transferring cream.

5. Acid measure or dipper—9 c.c. capacity.

6. Glymol—red reader—to eliminate the curve or meniscus at the top of the fat column in cream testing.

Additional Equipment for Skim-Milk, Buttermilk, and Whey Testing.—Skim-milk bottles—double necked.

Operating the Babcock Test for Milk.—Preparation of the sample for testing means tempering it, usually by means of a water bath, to a temperature of between 60 and 70 degrees F. as determined by a thermometer, after which the sample is poured from one container to another at least six times to insure thorough mixing. Rapid pouring should be avoided, or air will be incorporated.

Measuring the Sample.—After mixing, insert the tip of the 17.6 c.c. pipette into the milk, holding with the thumb and second finger, then draw the milk up into the pipette by suction of the lips placed at the upper end until the level of the milk is above the graduation mark on the stem. Quickly place the tip of the dry forefinger over the upper end of the stem and gradually, by lessening the pressure, allow the milk to flow out until the upper surface, without regard to the meniscus, is level with the graduation mark. Then transfer the milk to a milk-test bottle, allowing the milk to run into it without spilling and blowing out the final drop. The 17.6 c.c. pipette delivers 17.5 c.c. of milk (sp. gr. 1.032) which weighs approximately 18 grams, and measuring is much quicker than weighing.

Adding the Acid.—Measure out 17.5 c.c. of commercial sulfuric acid (sp. gr. 1.82–1.83) at a temperature between 60 and 70 degrees F. into an acid measure or dipper. Holding the test bottle at an angle of 45 degrees with one hand, add two-thirds of the acid, rotating the test bottle slowly meanwhile so that the milk will be washed from the neck into the bottle and the curd will not be charred. Then shake the milk-test bottle with a rotary motion until the curd is completely dissolved, always keeping the mouth of the bottle away from the person to prevent the possibility of burns from spurting acid. If upon standing for a minute the contents of the bottle is not a deep chocolate brown, add additional portions of acid until the mixture after shaking and standing for a minute is that color. The reason acid should be added in this manner is that frequently there is considerable variation in the strength of the acid and the color test is the easiest way to determine the proper quantity in practice. Since acid grows weaker as it is exposed to the air, through taking up moisture, it is sometimes necessary to use larger quantities.

Centrifuging; Whirling.—*First time.*—As soon as the acid has been added, the test bottles should be placed in a Babcock tester or centrifuge and whirled, at the speed specified on the tester, for five minutes. Place bottles opposite each other for balancing, and if only a few tests are to be run, use the outside cups or pockets. The Babcock tester should always be set level and fastened securely. After the five-minute run, add water at a temperature of 180 degrees F. by means of the pipette, until the level of the liquid in the test bottle reaches the bottom of the neck.

Second time.—Whirl again for three minutes. Then carefully add water of the same temperature as above, until the top level of the fat column is a short distance below the top of the graduation on the neck, and the bottom level is above the zero mark on the graduation.

Third time.—Centrifuge for one minute, then remove the test bottles and place them in a water bath at a temperature between 135 and 140 degrees F. and allow to stand for five minutes. The water should come high enough on the neck of the test bottle to cover the fat column.

Reading the Tests.—Remove one test bottle at a time and, holding it vertical and level with the eye, place the points of the dividers against the neck of the bottle, the lower against the lower edge of the fat column and the upper against the extreme upper edge or curve of the fat column. Then carefully without moving the distance between the points of the dividers, place one point at zero and read the percentage of butter-fat on the graduated scale where the other point rests. The curved surfaces at the top and bottom of the column of fat are called menisci (plural of meniscus). In reading use the nearest point on the graduation and take the average of duplicate samples, which however should check within one-tenth of one per cent. Temperature affects the readings so make them rapidly after removing from the water bath.

Operating the Babcock Test for Cream.—*Weighing the Sample.*—There is so little difference in the weight of a given volume of different samples of milk that measuring is accurate for Babcock testing. Cream, however, varies so greatly in weight with the percentage of butter-fat that it contains that it is necessary to weigh it. Before weighing it is necessary to mix thoroughly the cream and have it at a temperature between 60 and 70 degrees F. Balance the cream bottle carefully on the scale, waiting until the pointer rests in the middle or swings an equal distance to each side. Then add carefully with the 9-c.c. cream pipette enough cream to balance a 9-gram weight set on the opposite pan of the scale. Add the last bit of cream slowly, drop by drop, so as not to get too much into the bottle.

Adding Acid.—Measure out 9 c.c. of commercial sulfuric acid at a temperature between 60 and 70 degrees F. into an acid measure or dipper. Add the acid carefully in the same manner as in the milk test, using only enough to produce a chocolate brown color in the contents of the bottle after shaking and upon standing for a minute. This means that the last third of the acid should be poured in a little at a time. Next add, by means of the pipette, between 10 c.c. and 15 c.c. of hot water (temperature at least 180 degrees F.) to retard the action of the acid and prevent charring. *The centrifuging or whirling* is exactly the same as in the case of milk, with water added in like manner.

Reading the Tests.—The bottles are placed in a water bath for five minutes as with the milk test, but a few drops of glymol or red reader are added to the top of each fat column to eliminate the meniscus when the reading is to be made. After the addition of glymol, the reading is made to the extremes of the fat column as with milk. The graduation marks of the cream bottle are in one-half per cent from 0 to 50 per cent. Accurate readings cannot be made closer than one-half per cent.

Babcock Test for Skim-Milk, Buttermilk, and Whey.—The same general procedure is followed for all three of these as with whole milk, with certain exceptions. In each case double-necked skim-milk test bottles of special design are used. One neck has graduations from zero to either 25/100 or 50/100 of one per cent, the smallest graduation being 1/100 of one per cent. Because of the greater percentage of solids-not-fat in skim-milk and buttermilk, from 19 c.c. to 20 c.c. of acid is used instead of 17.5 c.c. In the case of whey, from 8 c.c. to 12 c.c. of acid is used because of the small quantity of curd. With all these tests the filling neck should be placed toward the center of the centrifuge so that the passage of the fat into the small graduated neck will not be obstructed. The first whirling should be 10 minutes instead of 5 minutes. These tests may be read direct or with dividers.

Precautions and Suggestions.—1. *Never* add water to sulfuric acid as it will splash and spatter. If too strong, leave the acid exposed to the air; otherwise, always keep tightly corked.

2. Foreign matter in the fat column will cause inaccurate reading; in case of such, repeat the test.

3. Soft or distilled water is to be preferred for adding to tests. If neither is available, boiled water is satisfactory, or water to which a few drops of sulfuric acid has been added will usually give good results.

4. Whirl tests immediately after adding the acid if possible, otherwise

Summary of Procedure in Babcock Tests

Always run duplicate tests

	Whole Milk	Cream	Skim-milk or Buttermilk	Whey
Test bottle to use	8% or 10% whole milk bottles [1]	9 gm. 50% cream bottles [1]	Double necked skim-milk bottles	Double necked skim-milk bottles
Amount of sample to use in each test bottle	Measure 17.5 c.c.	Weigh 9 gms.	Measure 17.5 c.c.	Measure 17.5 c.c.
Approximate amount of acid to use (Sp. Gr. 1.82–1.83) (60–70° F.)	17.5 c.c.	9 c.c.	19–20 c.c.	8–10 c.c.
Centrifuge (whirl) first time	5 min.	Add 10–15 c.c. 180° F. water, then centrifuge 5 min.	10 min.	10 min.
Adding water, first time—180° F. or warmer	Enough to raise the butter-fat column to within about one-half inch of the base of the neck of the bottle			
Centrifuge (whirl), second time	3 min.	3 min.	3 min.	3 min.
Adding water, second time—180° F. or warmer	Enough to raise all of the butter-fat above the zero mark of the graduated scale on the neck of the test bottle			
Centrifuge (whirl), third time	1 min.	1 min.	1 min.	1 min.
Water bath, 135–140° F.	5 min.	5 min.	5 min.	5 min.
Reading, remove only one bottle from water bath at a time	Use dividers	Add a few drops of glymol and use dividers	Read direct or use dividers	

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[1] See Nebraska Standard Dairy Law, Bul. No. 3, State of Nebraska, Department of Agriculture.

warm them to 180 degrees F. for 10 minutes in a water bath before whirling.

Cleaning Glassware.—An important part of testing is proper cleaning of glassware. Pipettes should be rinsed out with cold or lukewarm water immediately after use, then cleaned with hot water and washing powder by means of a brush, and finally rinsed in clean hot water. After a test and while the bottles are still hot, the contents should be emptied over an ash pile or into a stone or glass jar, shaking meanwhile completely to dislodge the white ash sediment in the bottom. Then they should be rinsed and shaken until clean. Coarse sand or small shot will often prove useful in cleaning. Then rinse with clean hot water. Dirty glassware is unsightly and may cause inaccurate tests.

Composite Sampling.—A composite sample is one composed of proportionate quantities by weight of several different samples of milk or cream. For example, suppose a cow is producing 40 pounds of milk a day in two milkings; at the morning milking she produces 24 pounds and at the evening milking, 16 pounds. Only one test is to be run and that is to cover the entire day, and since there is no likelihood that the milk will test the same at each milking, a composite sample is made. To be accurate, the composite sample must contain parts of each milking.

To make up a composite sample, a graduated pipette is very convenient, although a small dipper made from a shot-gun shell can be used. For each pound of milk, use a definite number of cubic centimeters or dips of the dipper, depending on the quantities of milk in the individual samples. In the case illustrated, 3 c.c. for each pound of milk would produce 120 c.c., 24 x 3 = 72 c.c. from the morning milk, and 16 x 3 = 48 c.c. from the evening milk. The two lots are then mixed together thoroughly before samples are tested.

The composite sample may cover a longer period, and may be used for either milk or cream. In sampling milk or cream in cans of equal size a long slotted tube with a turning case, called a sampling tube, is used with good results. Such sampling is much more rapid and convenient, especially for cream, because cream is viscous and sticks to a pipette.

Variations in Quantity and Quality of Milk.—*Individual Variation.*—A cow does not produce the same quantity of milk at the same milking on different days nor does the milk contain the same percentage of butter-fat at different milkings or on different days. Because of the individual variation, the milk of a herd may vary in both quantity and percentage of butter-fat from day to day. The table shows the individual variation.

Milking	1st Day			2nd Day			3rd Day			4th Day		
	Milk lbs.	Fat %	Fat lbs.	Milk lbs.	Fat %	Fat lbs.	Milk lbs.	Fat %	Fat lbs.	Milk lbs.	Fat %	Fat lbs.
A. M.	20.3	4.5	.91	19.4	4.9	.95	21.0	4.5	.95	22.2	4.4	.98
Noon	14.4	5.1	.73	16.4	5.4	.89	18.4	4.9	.90	18.0	4.5	.81
P. M.	13.4	5.9	.79	15.6	5.1	.80	15.5	5.1	.79	16.6	4.9	.81
Midnight	15.4	4.8	.74	17.4	4.2	.73	18.1	4.9	.89	17.8	4.4	.78
Daily totals	63.5		3.17	68.8		3.37	73.0		3.53	74.6		3.38
Daily fat %		5.0			4.9			4.8			4.5	

Milking	5th Day			6th Day			7th Day			Total Av.		Total Fat lbs.
	Milk lbs.	Fat %	Fat lbs.	Milk lbs.	Fat %	Fat lbs.	Milk lbs.	Fat %	Fat lbs.	Milk lbs.	Fat %	
A. M.	22.1	3.7	.82	24.6	4.3	1.06	24.9	4.4	1.10	154.5	4.38	6.77
Noon	19.0	4.6	.87	19.4	4.5	.87	19.0	5.0	.95	124.6	4.83	6.02
P. M.	19.0	4.6	.87	17.2	4.9	.84	17.4	4.9	.85	114.7	5.01	5.75
Midnight	18.1	4.4	.80	18.3	4.2	.77	17.9	4.9	.86	123.0	4.53	5.57
Daily totals	78.2		3.36	79.5		3.53	79.2		3.76	516.8		24.11
Daily fat %		4.3			4.4			4.7			4.66	

Individual Variation Through Nearly Thirteen Months of Lactation

Month of Lactation	1	2	3	4	5	6	7
Days in milk	13	30	31	30	31	31	28
Total milk, lbs	637.5	2140.3	2283.3	2094.3	1943.8	1864.0	1654.7
Av. milk per day, lbs	49.0	71.3	73.6	69.8	62.7	60.1	55.5
Av. fat, %*	2.77	2.77	3.23	3.06	3.42	3.42	3.37

Month of Lactation	8	9	10	11	12	13
Days in milk	31	30	31	30	31	22
Total milk, lbs	1801.7	1646.9	1788.0	1630.2	1431.0	901.0
Av. milk per day, lbs	58.1	54.8	57.6	54.3	46.1	40.9
Av. fat, %*	3.45	3.60	3.63	3.80	4.04	3.51

* The average test of two days milk in the middle of each month.

Environment.—Feed.—Changes in the method of handling cows, changes of milkers, excitement, change in the hours of milking, in fact anything that tends to disturb the regular routine may affect the quantity of milk, and also the percentage of butter-fat, either increasing or decreasing it. Cool or cold weather tends to cause the cow to produce a higher percentage of butter-fat; hot, moist weather tends to reduce the percentage. For a cow properly fed, the percentage of butter-fat is not permanently affected by the feed. Cows that have been underfed may increase in butter-fat percentage when given a proper ration. Early spring pasture tends to reduce temporarily the butter-fat percentage in the milk.

Variations in Cream Tests.—*Richness of the Milk.*—The percentage of butter-fat in the cream may vary because of variation in the percentage of butter-fat in the milk. In a cream separator, the cream or skim-milk screw is adjusted to deliver a certain proportion of skim-milk to cream. Suppose that the separator is adjusted to deliver 16 pounds of cream to 84 pounds of skim-milk. If the milk on one day tested 3.2 per cent fat, then 100 pounds of milk would produce 16 pounds cream containing 3.2 pounds fat, or the cream would test 20 per cent ($3.2 \div 16 = .20$). If on the next day the milk tested 3.6 per cent fat, then the 16 pounds cream would contain 3.6 pounds fat and would test 22.5 per cent. ($3.6 \div 16 = .225$).

Speed of Separation.—A cream separator is adjusted to operate at a definite speed. If it is run faster, there is a greater amount of centrifugal force exerted upon the milk and the cream will be richer; if it is run slower the cream will test lower in percentage of butter-fat.

Temperature of the Milk.—Between 90 and 98 degrees F. is the range of temperatures at which separators operate most efficiently. Milk that is colder will frequently not separate completely, causing a loss of fat in the skim-milk.

Rate of Milk-Flow into Separator Bowl.—When the valve governing the flow of milk into the separator is not open wide, or the supply tank is only partially filled, there is less pressure behind the milk and the rate of inflow is decreased. This tends to cause richer cream.

Adjustment of Skim-Milk or Cream Screw.—A separator has in the separator bowl a small outlet for cream or for skim-milk that is adjustable as to its distance from the center of the separator. This is called the cream screw or skim-milk screw as the case may be. The farther in the cream outlet is adjusted, the richer the cream; and vice versa. The skim-milk screw when adjusted the same way produces exactly the opposite effect.

Quantity of Flush Water.—To remove the last cream that is in the bowl or in the spouts, clean warm water is put into the separator at the completion of separation while the machine is still running. The use of different quantities will affect the richness of the cream.

Vibration of Bowl.—A cream separator is a finely adjusted mechanism that operates when properly adjusted, but if the bowl vibrates, if the spindle is bent, or if it is improperly adjusted, it will not separate efficiently, and a loss of butter-fat may result.

Job 11. Planning Dairy-Farm Buildings

Conditions Usually Found.—(1) Where dairying is to assume some importance among the farm enterprises, it is necessary to provide adequate accommodations for the cows and conveniences for carrying on the business. (2) The principles of the planning of the buildings, inside arrangement, and location with reference to other buildings are useful whether new buildings are needed or remodeling is to be done.

Aims.—(1) Students should know how to plan a convenient dairy barn. (2) Milk-house arrangement and equipment for the production and handling of clean milk in as economical manner as possible should be studied.

Topics for Study and Discussion.—(1) What are the important points to consider in the location of a barn and milk house?

2. What types of barns are in use locally?
3. Show how each is or is not well adapted to the conditions. Make suggestions for improvements.
4. What are the essentials for inside arrangement and equipment for a good dairy barn? Give reasons.
5. Which of the tools and machines listed are common locally?
6. How would they add to the farm conveniences?
7. Give the essential features of a milk house.
8. Are silos prevalent locally? What kinds are used? What kinds would be most suitable and least expensive?

Activities.—(1) Draw plans of a sanitary barn to suit local conditions. (2) Draw plans for a loose-stock barn for feeding roughage only. (3) Make a list of materials for a dairy barn and get prices from local dealers. (4) Send for catalogs and make up a list of equipment and prices for each item to suit your conditions.

Location.—Farm buildings properly arranged and constructed reduce the labor necessary to care for a dairy herd, and make possible the production of clean wholesome milk. The buildings on a dairy farm should be placed with reference to convenience, sanitation, drainage, sunlight and relation to other buildings.

In placing the barn, if it is to have two rows of cows, it should be placed with its long axis running north and south and nothing should obstruct the south end from sunshine. If only a single row of cows is to be placed in the barn, then the barn should run east and west and the cows should be placed on the south side. In barns already built, this arrangement is not always possible, and sometimes other buildings or the character of the slope prevents it in new construction. If there is a good slope away from the barn, but not so steep as to make it hard for cows to climb or to cause soil to wash, and if the soil is sandy or gravelly, the conditions are ideal. If natural drainage is not available, then the grounds should be graded to drain away from the building.

The barn should be at sufficient distance from the house so that odors and flies will be avoided. The milk house is ideally located a short distance away from the barn, although it may be a part of that building. Buildings should be so placed that cattle can be moved to and from pasture with the least labor, and water tanks should be so located that water is available in lots and pastures.

Types of Barns.—There are a number of types of dairy barns, such as one-story, two-story, round, rectangular, basement, and shed (Figs. 24 and 25). The type best suited for a particular condition depends upon the kind and size of the dairy herd, the climate, the slope of the land, the other buildings, and other conditions. Usually a rectangular barn, either one-story or two-story, is most satisfactory for general farm conditions. Round barns have had their advocates but have never become popular, and basement barns are likely to be damp and ill ventilated.

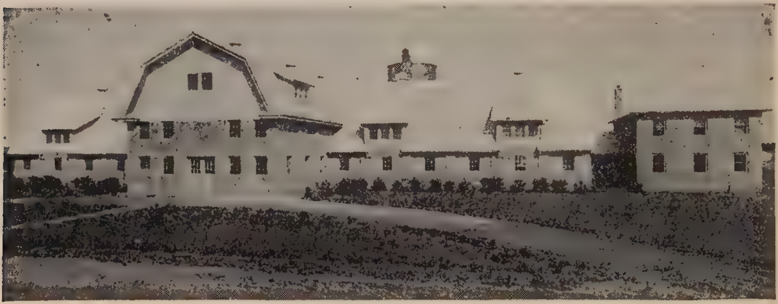

Fig. 24.—Ideal type of dairy barn, with milkhouse at right under same roof, yet separated from the dust and odors of the barn. (Univ. of Neb.)

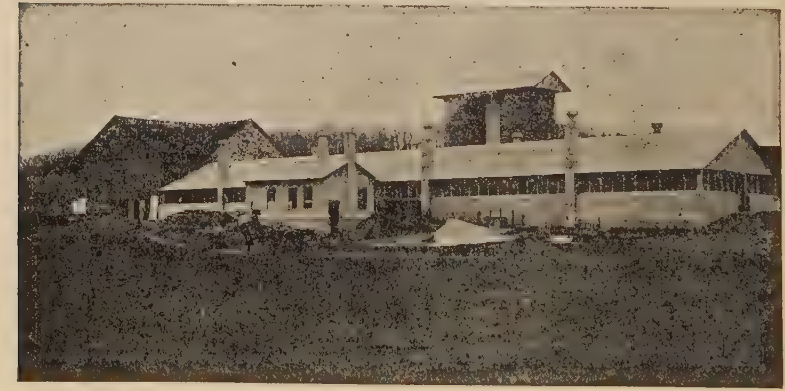

Fig. 25.—Commercial milk dairies must have sanitary barns. The walls in this barn are of concrete and glass. The milk room is handy but separate. No feed is stored over the cows, and none near the milk room. (Sharples Separator Co.)

Shed barns are often practical, and are economically constructed next to other barns to house dairy cattle. A simple shed barn for one row of cows can be constructed and the other row added at a later date. The roof may be of the shed type on small barns, or gambrel or Gothic type on larger two-story barns.

Size of Barn.—The size of the barn is governed by the number of animals to be housed and the storage space required. Storage of feed, particularly hay, above the part used for housing animals adds greatly to the convenience of a barn. The lowest cost per animal housed is of importance in the barn if it is to be used primarily for housing livestock. On most farms, the barn is used not only for cows, but for the bull, the calves, and perhaps for the horses. In such a case there should be a partition shutting off the horses from the cattle.

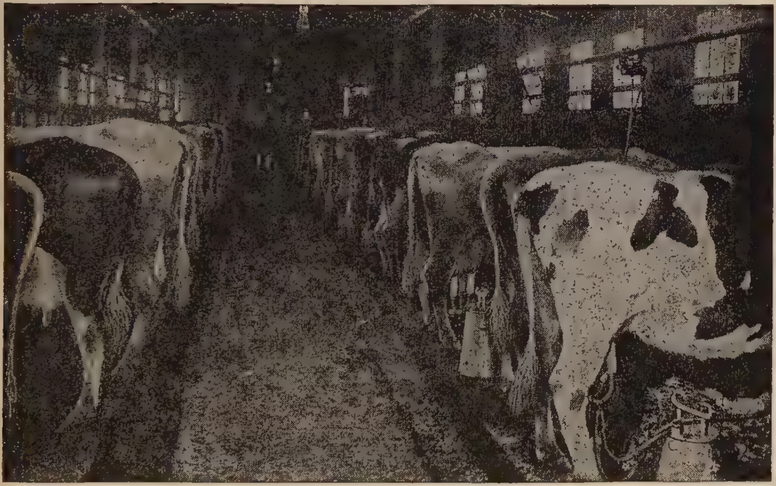

Fig. 26.—Interior of modern dairy barn, showing window, light and ventilation, manure gutters, and central walk. Milking machines are at work. Some dairymen prefer to have the two lines of cows face each other. (Cromwell's, "Agriculture and Life.")

The inside arrangement of the dairy barn should be such as to reduce labor to the minimum (Fig. 26). Convenience saves labor and cost. A common plan places the cows in two rows of stanchions, the animals facing either in or out. Such a plan necessitates a barn from 32 to 36 feet wide and of suitable length. It is usually figured that a cow needs 3½ to 4 feet of stall width, and the length of barn may be such as to accommodate any number of animals desired, plus the space needed for alleys and other purposes. Facing cows in makes for feeding convenience and permits sunlight in the gutters, but this arrangement does not provide for a driveway that can be used for hauling away manure and usually results in dirty side walls. Facing cows out provides a more convenient arrangement for removing the manure, keeping the barn clean, and making it more convenient for milking, especially if milking machines are used, since an operator can milk cows on both sides of the driveway. All walk-ways should be at least four and preferably five feet wide. Doors should be not less than four feet in width to permit easy access by cows, feed trucks, and carriers.

Ceiling and Walls.—The ceiling should be tight and smooth so as to catch as little dirt as possible and be easy to clean, and it may vary in height from eight to nine feet above the floor. The walls may be of wood, brick, tile, stone or plaster. They should be tight, insulated for warmth, and smooth and water-proof for easy cleaning.

The floor of a dairy barn should be of concrete and should be provided with drains in the gutters, in the mangers, and in other parts of the barn if it is to be washed frequently. The platforms on which the cows stand and those parts of the barn where they walk should have a wood-float finish on the concrete to prevent slipping. All other parts should be smoothly troweled, since such a finish is much easier to keep clean. Sometimes the platforms on which the cows stand are covered with pressed cork brick or with creosoted wood blocks, to make a warmer insulated surface for the cows to lie upon, especially in winter. The top layer of concrete may be insulated from the part below by a layer of tar or of tar paper placed before the top coat is laid. This will keep the floor dry and warm. Platforms vary with the size of the cows from 4 feet 8 inches to 5 feet 4 inches in length, and are measured from the middle of the stanchion line to the edge of the gutter.

The gutter is a straight-sided depression immediately back of the platform on which the cow stands, to catch the manure (Fig. 26). Gutters vary in depth from five to ten inches and in width from fourteen to sixteen inches. They slope toward drains which are located either in the middle or at each end of a moderate-sized barn. The drain should be of ample capacity, since a small one frequently becomes clogged with straw or litter, and should empty into a tank.

Mangers in a two-row stanchion barn measure from the middle of the stanchion to the front of the manger from 30 to 36 inches. This usually provides ample space for feeding hay so that very little is thrown out.

Stanchions of one or another type are the most common kind of cow tie in America (Fig. 26). A stanchion consists of upright wooden or metal pieces forming a yoke that opens at the top and is suspended top and bottom. The stanchion is usually suspended from chains so that the cow can turn her head and have considerable freedom but cannot move much out of line backwards and forwards. In fact, many stanchions have adjustments that furnish a means of adjusting a cow's position on the platform so that the manure will fall into the gutter.

Some means of ventilation must be provided, especially in cold climates, since cows need fresh air to do their work properly and remain healthy (Fig. 27). One of the simplest methods consists of windows that tip in at the top against side partitions so that the air enters only over the top of the window. The adjustments are made according to the outside and inside conditions so as to insure fresh air but avoid drafts. A more complicated system consists of air-tight flues running as straight as possible either from the ceiling or from 12 to 18 inches above the floor to the roof as a sort of chimney. Each outlet should be not less than 18 inches square, and a cross-sectional area of from 24 to 30 square inches is needed per cow. A few large outlets are better than several small outlets.

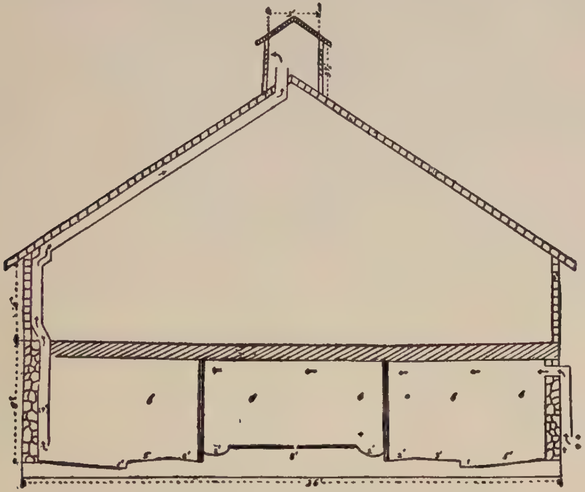

Fig. 27.—King system of ventilation for dairy barns. The air outlet should start near the floor and extend through the roof. The inlet for air into the stable is near the ceiling, but should start outside well above the ground. Windows are for light, not for ventilation, when the King system is in use. Note the plan of the floor.

To admit air, inlets or openings in the side wall are provided from eight to twelve feet apart, with the inside openings near the ceiling and the outside openings a few feet lower to prevent a direct draft. This system of ventilation, sometimes called the King system, depends for its satisfactory operation upon the difference in temperature between air inside the barn and air outside the barn. The barn must be tight and the doors and windows closed for the system to work efficiently.

Light.—A barn should have as much light as possible in those parts that house the cows. Four square feet of glass per cow is considered a good standard but more is desirable, and the windows should be of such a height above the floor that sunlight reaches as much of the barn as possible. Too much light is impossible in a dairy barn. If possible, electric lights also should be installed, as they are convenient and reduce the fire hazard.

Box-stalls are essential for the proper caring for the herd. In general, there should be enough box-stalls to care for at least 10 per cent of the herd at one time. Box-stalls are necessary for calving stalls in cold or inclement weather and for sick or injured cows. In size, box-stalls should not be smaller than 10 by 10 feet and larger sizes are usually a little more convenient. Ten by 12 feet is a very comfortable size, and is the minimum for large cows. A large box-stall in the barn, heavily built with high partitions or bars, is frequently used for keeping the herd bull, although a pen of his own with a large exercise yard is to be preferred.

Small pens for calves, 4 by 7 feet for individual pens for small calves, and large pens with stanchions along one side for the older calves, may be placed at one end of the barn. The calf pens should be warm and should open into sunny lots. Small mangers in front of the pens are sometimes used and in the smaller pens, a rack for hay and a box for grain are convenient.

Feed Room.—A feed room should be provided on the main floor, where the grain is kept in bins and grinding and mixing facilities are provided. Grain is usually fed more easily from trucks, and these should have a rod or pipe with swinging arm from which a spring balance or scale is suspended to weigh grain. A small pail is quite convenient for this purpose. Carriers that run on a track are sometimes used for feeding, but trucks are usually more satisfactory for feeding both grain and silage.

Carrier.—For manure disposal, a carrier on an overhead track is the ideal system, since the track can be arranged to reach all parts of the barn, and the carrier once loaded can be dumped directly on the spreader or wagon or into a manure pit. A concrete platform or manure pit is useful for holding manure and keeps the yards in better shape. If possible, manure should be removed and spread on the land at once. In some barns where the cows face out, the manure spreader is driven through the barn and cleaning is done in that way.

Water.—Running water in the barn is a great convenience. Some barns are so equipped that every cow has an individual water trough with its level maintained by means of floats. (Fig. 26). Running water on pressure is very useful in washing out the barn, especially in the summer time. Drains are needed in the gutters, but they may also be placed in the mangers, in which case the concrete manger may be used as a watering trough.

Milking machines are now in fairly common use. (Fig. 26). A milking machine depends in principle upon suction by a vacuum pump with relief furnished at regular intervals, either by the admission of outside air or by the admission of air under pressure to the system. A certain amount of mechanical pressure is exerted in some machines, which may assist in the milking process. A milking machine is usually too expensive to install for fewer than 15 milking cows, although that will depend upon the conditions. Electricity is desirable to operate a milking machine because of its even flow of power, although gasoline engines are used successfully. By means of a machine, a man may milk from three to six cows at once according to his speed, the kind of milker, the type of unit (either one- or two-cow), the arrangement of the barn, and the production of the cows.

To operate a milking machine efficiently, the first few streams of milk should be drawn from each quarter by hand, and after removal of the machine the cow should be stripped to be sure that she is dry. Ordinarily, only a negligible quantity of milk remains in the udder after the machine is removed, but occasionally a cow will hold up her milk, not yielding it to the machine.

The cleaning of milking machines is very important if clean milk is to be produced. First the machine should be rinsed by sucking several pails of clean cold or lukewarm water through each milking unit, then hot water containing an alkali solution should be sucked through the machine followed by clean, hot water. Once a day the rubber parts should be taken apart and scrubbed with a brush and the pail and metal parts that come in contact with the milk should be thoroughly steamed. After washing, the rubber parts should be placed, until used again, in a jar containing a saturated brine solution or a solution of calcium chloride.

Tools.—Proper tools in the barn make the work lighter. These include:

Three-tined fork for hay
Four- or six-tined fork for manure
Wide, many-tined fork for silage
Heavy brooms
Stiff push brushes
Long-handled straight-sided shovels
Scoop shovels for mixing grain
Halters
Hand axe
Saw
Hammer
Pliers
Screw driver
Brace and bits
Long-handled wood chisel
Hoof knife

Long rope for throwing animals
Common pails
Milk stools
Hoof nippers
Clippers

For veterinary work are needed:

Milk-fever outfit
Thermometer
Trocar and cannula
Pair of scissors
Drenching bottle
Rubber tube with funnel
Tincture of iodine
Epsom salts
Saltpetre
Vaseline
Camphorated oil
Formalin
Compound solution of cresol
Sticks of caustic potash
Some common disinfectant

Location and Arrangement of Milk House.—If possible, have the milk house a short distance from the barn in order to get away from flies and barn odors, but not so far away as to make taking milk to it laborious and inconvenient. In many instances, it can be placed close enough to have a connecting passage-way with swinging doors. Sometimes the milk house consists of a room in the barn, and if this is the case, great care should be taken to see that it is so constructed as to have plenty of sunlight and to be kept clean easily. Whatever the location, it should have a concrete floor with a drain, running water if that is available, and plenty of windows and tight walls, and should be screened. Ideally, a milk house should have plenty of sun on the side where washing is done, and shade on the side where the milk is cooled and stored, and should be surrounded with grass to prevent dust.

Equipment.—Within the milk house are the milk sheets in their holders and scales for weighing the milk, the cooler, the milk-storage room or tank, the washing equipment, and the cream separator. For weighing the milk, a spring balance with an adjustable hand to balance the pail is suspended from a bracket at a convenient height. All the milk pails may be made to weigh the same by adding a few drops of solder to the lighter ones. Pails stamped from a single piece of metal, and consequently without seams except where the hood is fastened on, wear the best. The hood covers the top of the pail and keeps out dirt during milking. On the wall near the milk scales the milk sheets should be fastened in a frame or case which is adjustable so that only one day is exposed at a time, thus preventing the sheets from getting soiled.

Coolers of various kinds are in use, but a surface cooler that has the milk run over the outer surface with cold water on the inside is simple and efficient. With a circulating water supply, the milk can be cooled to within a few degrees of the temperature of the water.

If sufficient care were used in milking, strainers would be unnecessary. In practice a substantially built strainer that uses sterilized filter cloth or cotton for straining is to be recommended. A common custom is to have in the milk house, partly below the floor, a concrete tank that can be filled with cold running water, in which are placed the cans of milk or cream after cooling. Such a tank should have a drain for cleaning, an inlet below, and an outlet at the surface of the water in the form of an overflow pipe. A two inch pipe is satisfactory for this, with the lower drain fixed so that the overflow pipe will screw into it. To drain the tank, unscrew the overflow pipe.

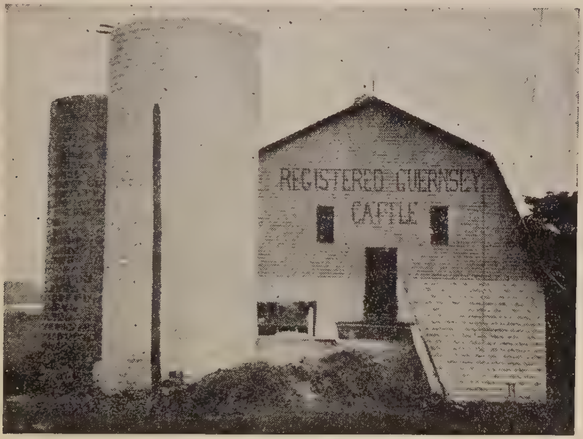

FIG. 28.—A side-bank dairy barn with a tile silo (dark) and a cement block silo (white) well located for handy feeding.

A cream separator, if needed, may be placed in one corner of the milk house and fastened level and firmly to the floor. In selecting a cream separator, remember that careful manufacturing will tell in the useful life of a separator. A separator that has a local distributor has the advantage of service and parts.

For washing, a galvanized-iron wash tank or sink with a drain shelf is convenient. For heating water and for steam, some type of heater or boiler is necessary. Boilers are expensive, but a water heater of some kind can be afforded by any farm. Plenty of hot water, a good alkali washing powder, and a stiff brush are the essentials for getting milk utensils clean. Racks on which the pails and other dairy utensils may air upside down are useful but should not be placed in a dusty place.

The milk house is the place for the Babcock testing equipment, including the centrifuge or tester and the other equipment. The tester may be fastened securely to a table, and the rest of the equipment kept in a box or cupboard. All dairy equipment connected with milk is kept in the milk house when not in use.

Silos have been used for the storage of feed since the time of the Romans. A silo (Fig. 28) is a container with air-tight walls into which finely cut green forage is tightly packed for use out of season and in which the forage is preserved by partial fermentation. Silage is made by the partial fermentation of the sugar in the forage, that turns to acid and thus preserves the forage if it is tightly packed. Types of silos are discussed in Job 4, beef section.

Silage is probably as near a substitute for pasture as can be obtained in the winter and is very generally used in the United States, especially where the pasture season is short. Because of its succulence it is very important in dairying. Crops used for silage are innumerable, but corn is one of the best. Sweet sorghum, grain sorghum, sunflowers, oats-and-peas, peas, and many other crops are used for making silage. The best silage is made from a crop that has considerable sugar in it.

Job 12. Showing and Selling Cattle

Conditions Usually Found.—(1) Pure-bred dairy cattle are often shown at fairs. (2) Most exhibitors are skilful in preparing and showing stock. (3) Many breeders advertise in farm papers and use other advertising methods. (4) Auction sales are not infrequently held.

Aims.—Methods of preparing stock for exhibition and for sales should be understood. The methods of advertising, showing, and conducting sales should be known.

Problems for Study and Discussion.—(1) At how many state and county fairs do some of the progressive dairymen show their herds or individuals?

2. Find where the National Dairy Show was held recently.
3. What advertising value comes from exhibiting at state and county fairs?
4. Compare the relative merits of ancestry, individuality and production in advertising pure-bred dairy cattle.
5. What help can be given a breeder by field agents of his dairy breed association?
6. Describe the preparation of cattle for show.
7. Of what value is frequent washing in advance?
8. What is the value of blanketing?
9. Why do you polish and oil the horns?
10. Why does continuous, careful handling aid at exhibition time?
11. Describe how to make a mature animal show to good advantage.
12. Debate private sales vs. public auctions.
13. Tell how to prepare a sale catalog.

Activities.—(1) Prepare calves and other animals for fairs or for sale. (2) Mark cattle intended for show or for sale. (3) Train animals to handle well for a show or for sale. (4) Send for sale catalogs of other breeders. (5) Imitate one of the best of these in preparing a sale catalog for yourself or a local breeder.

Value of Advertising.—Progressive breeders of pure-bred cattle find it necessary to advertise their stock. They have each year surplus animals which must be sold. Better prices are obtained if sound advertising methods are used. Buyers must be led to have confidence in the breeder. If the reputation of a breeder is large and good, buyers will not hesitate to trust him.

There are several methods of wholesome advertising. (1) Showing cattle at fairs and winning premiums. (2) Advertising rather constantly in reliable farm papers. (3) Keeping the public informed regarding the production and ancestry of members of the herd.

Preparing Cattle for Show.—(Fig. 29). Individuality is the factor which counts most for winning at a fair. Pedigrees and production are not considered by judges at fairs. An animal must be prepared well in order to show well. There are several steps in preparing cows and other dairy cattle for show: (1) clipping the long hair; (2) trimming feet; (3) polishing and dressing horns; (4) washing the entire coat to make it clean and to soften the skin and hair; (5) blanketing the body to bleach out sunburn and soften the skin; (6) grooming to encourage natural skin secretions and improve appearance; (7) handling and posing the animal to present good effects.

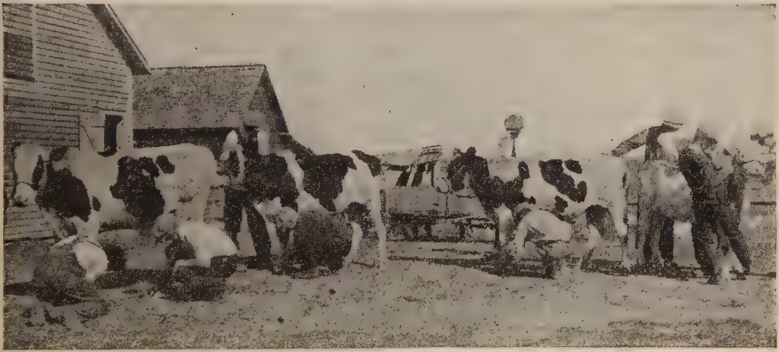

Fig. 29.—Students fitting heifers for show at the fair.

Preparations should begin some weeks before the fair by keeping the animal out of the intense heat of the sun and feeding to produce a good condition of flesh and finish. Feeds should be used which will tend to increase the luster of the coat and cause the animal to appear and feel in fine condition. The digestive tract must be kept active rather than sluggish. Some linseed meal added to the grain ration will help greatly. Changes in feed must be made gradually. Such feed should be used as will be furnished at fairs. Animals that are to be shown must be taught to walk and stand under halter so as to exhibit their good points. Good manners for cattle are essential to successful showmanship.

Making Private Sales.—When pure-bred dairy cattle are advertised in farm papers the breeder should be ready to send a typewritten or mimeographed copy of the pedigree of the animal and his ancestors to each prospective buyer. A photograph of the animal taken with a good pose, as shown in figure 3 or 9, should help in many cases. The production record of the ancestors should be given. Thus the prospective buyer is informed of the three main factors—ancestry, production, and individuality.

When animals are exhibited at fairs the owner or herdsman should be ready to give such information in printed form to each inquirer at the fair. Exhibitors often make sales at fairs. It pays to take snapshots of a number of the members of the herd left at home so that they can be shown to parties manifesting an interest in the animals exhibited.

Public Sales.—Individual dairymen or groups of breeders often conduct dispersal sales. Buyers are likely to be suspicious of these sales because they fear the breeders are selling their culls. To remove this fear on the part of the buyers and the public in general, inferior animals should never be offered at auction. Confidence in the breeder must be strengthened in every way. Attractive catalogs with pictures of herd leaders should be printed and sent to prospective buyers. Advertising in breed journals usually pays.

The field agent of the breed association should be asked to coöperate (1) in the selection of the individuals to be offered; (2) in the preparation of the sale catalog; (3) in the preparation of reading matter for the breed journal and agriculture papers; (4) in the preparation of paid advertising matter; (5) in the selection of a good auctioneer; (6) in the plans for the conducting of a sale.

All animals sold at public or private sales for breeding purposes must be guaranteed to breed, and if they do not adjustment must be made. Always tell of any defect that animals may possess at the time of sale so that the buyer may be protected.

Selling Surplus.—The disposal of old animals or those otherwise unfit for dairy purposes may be made to the butcher for beef. Grade bull calves can find a ready sale for veal. In most herds there are produced more females than are needed to maintain the herd. All surplus females must be sold and they may furnish a considerable income. They may be sold as heifer calves a few days old or at older ages, depending upon the demand, and the cost of raising. Before selling any females, selection should be made from them based upon the records of their mothers and their appearance so that enough of the best ones are retained to maintain the herd.

Job 13. Producing and Selling Milk

Conditions Usually Found.—Milk is produced as a side line with little care being taken as to its careful sanitary production or its sale to the most profitable market.

Aim.—Farmers and beginners should become familiar with the principles of sanitary milk production and the comparative returns from different methods of selling dairy products.

Problems for Study and Discussion.—(1) What is milk? Where secreted?
2. Why does a cow hold up her milk?
3. What are the constituents of milk and for what used?
4. Why is skim-milk a valuable feed for your animals?
5. Name important precautions in producing clean milk.
6. Compare all the local methods of marketing using local prices.
7. Discuss the vitamine properties in milk.
8. What conditions tend to prevent the increase of bacteria in milk?
9. Describe the personal habits of milkers which will aid in clean milk production.
10. Discuss the important points in the sanitation score card.
11. What is meant by certified milk?
12. Outline the daily work in preparing milk for sale in bottles.
13. List the daily tasks in a milk-distributing plant.
14. Ask milk distributors what proportion of their milk is never paid for by customers.
15. What are the conditions which tend to increase this loss?

Activities.—(1) Practise bottling milk. (2) Practise operating separators of several kinds if possible. (3) With a barn score card score one or more dairy barns in your region. (4) Join a milkman on his delivery route for a day or more and assist him in his work.

Milk, as we think of it, is the whitish, sweet secretion that comes from the complete milking of one or more healthy cows. Milk exists in the cow's body only in the udder. In that organ it is manufactured from various ingredients furnished by the blood. The udder is therefore a secretory gland and its functioning is governed by certain little-known substances. Plenty of feed tends to stimulate the production of milk, especially where the cow has the inherent ability to produce large quantities. Every cow has a definite limit of milk production, above which she cannot go. Under ordinary farm conditions that limit is seldom reached. At milking time, much of the milk is already in the udder, but by means of involuntary muscles at the top and near the bottom of the teats, the milk may be withheld. Rough, harsh treatment irritates the cow and tends to make her hold up her milk. On the other hand, kind and gentle treatment stimulates the production of milk.

Other animals produce milk, and the milk goat is much used for this purpose. In some countries sheep and water buffaloes are kept for milk production.

Milk Composition.—Milk is composed of water, casein, albumen, milk sugar (lactose), butter-fat and ash or minerals, and when first secreted is a yellowish-white fluid. The yellow color comes from the fat and the white color from the casein.

Casein is the chief constituent of cheese. It is one of the proteins and is useful for building blood and tissue. Commercially, casein is an important constituent of waterproof glues used in cabinet making, of sizing for fine paper, and of a product used for making fountain pen barrels and toilet articles. Casein has very strong adhesive properties which makes it adaptable for many uses. In milk, the casein is in the form of minute white particles held in suspension in the water, and these give the white color to milk.

Albumen in milk is similar to the white of egg and is one of the proteins. Albumen is very easily digested and is important in the diet of invalids and children. It is held in solution in milk.

Milk sugar (lactose) is in solution in milk. Bacteria act upon lactose and change it into lactic acid, thus souring the milk. Commercially, milk sugar is an important constituent of pills.

Butter-fat exists in milk in the form of minute globules or droplets in emulsion in the milk. The butter-fat is the most valuable part of the milk and in general the quantity of butter-fat present determines the price. Butter-fat is the chief constituent of butter, forming about 83 per cent of that product. It is very digestible and is one of the finest-flavored fats used for food.

The milk minerals, or ash, contain bone-building material and are essential for the growth of young children and for proper health maintenance in adults.

Vitamines.—In addition, milk contains vitamines that are vitally needed for the proper growth and continued health and development of children. To a limited extent, these are also needed for adults.

The proportion of the different constituents in milk may vary with the breed of cattle, season of year, condition of the animals, and many other causes. An average composition of milk is as follows:

Percentage Composition of Milk

Water						87.65
Casein	2.65					
Albumen	60					
Total protein		3.25	Solids not fat	8.65	Total Solids	12.35
Milk sugar		4.70				
Milk minerals		.70				
Butter-fat				3.70		
Total						100.00

The greatest variation in composition of milk is in the butter-fat. To a limited extent, the casein and albumen and milk sugar vary with the butter-fat, but not in direct proportion.

Sanitation.—As it comes from the normal, healthy cow, milk has but few bacteria in it. Most of these are lodged in the lower part of the teat and may easily be washed out by discarding the first few streams of milk from each quarter of the udder, a practice which is to be encouraged. These first few streams of milk contain but little butter-fat, so there is little real loss. As milking progresses, there is more and more butter-fat secreted, so that the last few streams of milk, or the *strippings*, as they are sometimes called, are very, very rich, sometimes even being as rich as thin cream.

Milk for human consumption must be a clean, healthful product drawn and handled by healthy persons in a clean manner. Necessarily, the cows must be healthy. The tuberculin test is a method of determining the presence of tuberculosis. Conditions surrounding the handling of milk are important. It is practically impossible for dirty attendants to draw clean milk from dirty cows. Stables should be clean and free from dust, the cows should be brushed and their udders and teats washed before each milking, and the attendant should wear clean clothes and have clean, dry hands. Milk utensils properly washed and sterilized are an aid to clean milk production. Elaborate fittings in the barn or milk house are unnecessary, but cleanliness is vital.

After being produced in a clean manner, the milk must be kept in good condition. When cooled below 40 degrees F., bacteria that may be present in milk reproduce very slowly so that the quicker milk is cooled to that temperature or below, the better. If it is not possible to cool milk to 40 degrees F., then cool it as low as possible and at least to below 60 degrees F. The souring of milk is caused by various kinds of bacteria that feed upon the milk sugar (lactose) and change it into lactic acid. They work best at temperatures between 70 and 90 degrees F. When enough lactic acid has been produced, the milk tastes sour and curdles because of the action of the acid upon some of the milk constituents. While naturally soured milk is healthful, it cannot be used for as many purposes as sweet milk, and cannot be easily separated with a cream separator. Sweet milk is the most salable.

Milk Utensils.—A small-top milk pail (Fig. 30), because of the smaller opening through which dirt can enter the pail, is a great aid to the production of clean milk. All milk utensils should be smooth and free from cracks and crevices on the inside so as to be easily washed and kept clean.

Scoring Sanitation.—As a means of standardizing and judging equipment and methods used in clean milk production, a score card is frequently used for the sanitary inspection of farms. The one given was designed by the Bureau of Dairying, U. S. Department of Agriculture.

EQUIPMENT	SCORE	
	Perfect	Allowed
Cows		
Health	6	......
Apparently in good health 1		
If tested with tuberculin within a year and no tuberculosis is found, or if tested within six months and all reacting animals removed 5		
(If tested within a year and reacting animals are found and removed, 3)		
Food (clean and wholesome)	1	......
Water (clean and fresh)	1	......
Stables		
Location of stable	2	......
Well drained 1		
Free from contaminating surroundings 1		
Construction of stable	4	......
Tight, sound floor and proper gutter 2		
Smooth, tight walls and ceiling 1		
Proper stall tie and manger 1		
Provision for light: Four sq. ft. of glass per cow	4	......
(Three sq. ft. 3; 2 sq. ft. 2; 1 sq. ft. 1. Deduct for uneven distribution.)		
Bedding	1	......
Ventilation	7	......
Provision for fresh air, controllable flue system 3		
(Windows hinged at bottom, 1.5; sliding windows, 1; other openings, 0.5.)		
Cubic feet of space per cow, 500 ft. 3		
(Less than 500 ft., 2; less than 400 ft., 1; less than 300 ft., 0.)		
Provision for controlling temperature 1		
Utensils		
Construction and condition of utensils	1	......
Water for cleaning	1	......
(Clean, convenient and abundant.)		
Small-top milking pail	5	......
Milk cooler	1	......
Clean milking suits	1	......
Milk Room or Milk House		
Location: Free from contaminating surroundings	1	......
Construction of milk room	2	......
Floor, walls and ceiling 1		
Light, ventilation, screens 1		
Separate rooms for washing utensils and handling milk	1	......
Facilities for steam	1	......
(Hot water, 0.5.)		
Total	40	......

METHODS (Figs. 31, 32)	SCORE	
	Perfect	Allowed
Cows		
Clean	8	......
(Free from visible dirt, 6)		
Stables		
Cleanliness of stables	6	......
Floor 2		
Walls 1		
Ceilings and ledges 1		
Mangers and partitions 1		
Windows 1		
Stable air at milking-time	5	......
Freedom from dust 3		
Freedom from odors 2		
Cleanliness of bedding	1	......
Barnyard	2	......
Clean 1		
Well drained 1		
Removal of manure daily to 50 feet from stable (Fig. 31)	2	......
Milk Room or Milk House		
Cleanliness of milk room	3	......
Utensils and Milking		
Care and cleanliness of utensils	8	......
Thoroughly washed 2		
Sterilized in steam for 15 minutes 3		
(Placed over steam jet, or scalded with boiling water, 2)		
Protected from contamination 3		
Cleanliness of milking	9	......
Clean, dry hands 3		
Udders washed and wiped 6		
(Udders cleaned with moist cloth, 4; cleaned with dry cloth or brush at least 15 minutes before milking, 1.)		
Handling the Milk		
Cleanliness of attendants in milk room	2	......
Milk removed immediately from stable without pouring from pail	2	......
Cooled immediately after milking each cow	2	......
Cooled below 50° F.	5	......
(51° to 55°, 4; 56° to 60°, 2.)		
Stored below 50° F.	3	......
(51° to 55°, 2; 56° to 60°, 1.)		
Transportation below 50° F.	2	......
(51° to 55°, 1.5; 56° to 60°, 1)		
(If delivered twice a day, allow perfect score for storage and transportation.)		
Total	60	......

Equipment ....plus Methods..............equal..............FINAL SCORE

NOTE 1.—If any exceptionally filthy condition is found, particularly dirty utensils, the total score may be further limited.

NOTE 2.—If the water is exposed to dangerous contamination, or there is evidence of the presence of dangerous disease in animals or attendants, the score shall be 0.

Certified milk is milk produced under the very strict sanitary conditions laid down by a group of medical societies. A local medical society certifies the milk as being pure and produced under strict regulation as to the health of the cattle and men handling the milk, and as to the maximum number of bacteria that it may contain per cubic centimeter (c.c.). Samples of milk are examined by a bacteriologist daily and general conditions are inspected weekly. All of these inspections are expensive, so that certified milk is much more expensive than other milk, sometimes selling for twice as much per quart.

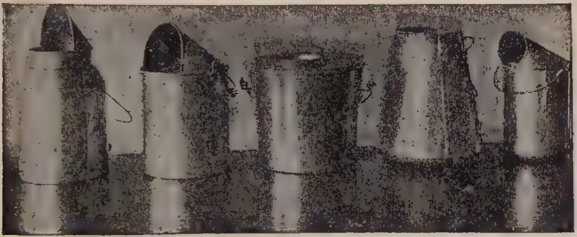

Fig. 30.—Five styles of milk pails, intended to reduce the amount of dirt in milk which falls in from cows and from milkers.

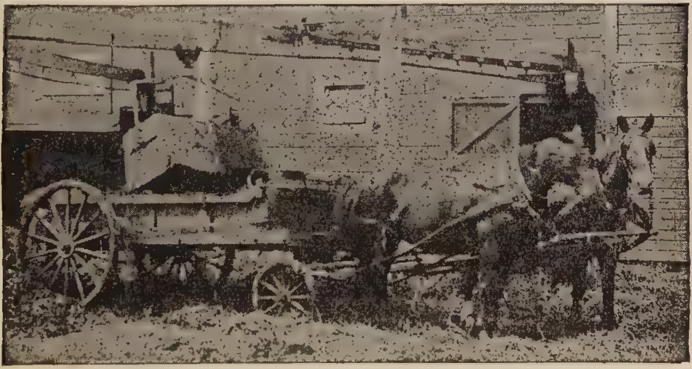

Fig. 31.—The modern manure spreader in the barnyard. A litter carrier which runs on an overhead track is used to take the manure from the barn. The figure shows the carrier in position of emptying into the spreader-box. The team is hitched on and the load is spread in a field.

Caring for Cream.—Sweet cream produced for sale should be cooled as quickly as possible to a low temperature (40 degrees F. if possible). If not disposed of after each separation, the cream should be thoroughly cooled before being added to the previous lot of cream. After adding, stir the cream well. Cream that is kept for any length of time should be kept in a cool place and should be protected against flies by a strainer cover.

Selling Milk.—Milk may be sold wholesale or retail. Selling milk wholesale usually consists of placing it in five-, eight-, or ten-gallon cans after straining and cooling. In the cans it is conveyed to the milk distributer, who bottles it (Fig. 33) and perhaps pasteurizes it before selling. Milk may be sold wholesale, also, to a milk condensery, or to a cheese factory. The price of milk, of course, varies in different places and at different seasons of the year. Usually it is quoted at so much per gallon or so much per 100 pounds, and the general standard is 3.5 per cent fat. Frequently, there is a differential paid for milk that tests higher in butterfat. For instance, the price may be $2.10 per 100 pounds of 3.5 per cent milk with an additional ten cents per hundred pounds for each one-tenth per cent test above 3.5 per cent or ten cents less for each one-tenth per

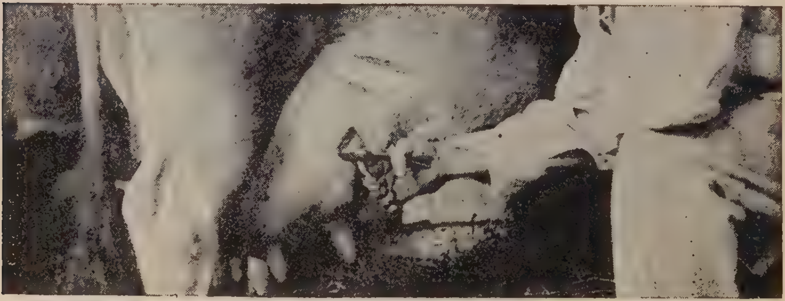

Fig. 32.—Hair about the udder, flanks and thighs should be kept short so that it will not hold dirt. (Kentucky Station.)

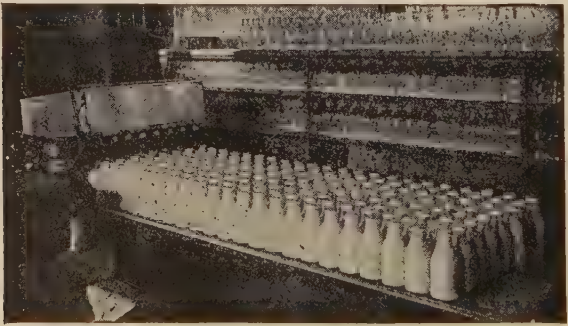

Fig. 33.—Milk bottled for the retail market. The machine at the left fills one row of bottles at a time. (Productive Farming.)

cent test under 3.5 per cent. As an example, suppose milk tested 3.7 per cent fat, then the price would be \$2.10 plus .20, or \$2.30, per hundred pounds. One hundred divided by 2.15 (the weight of a quart of milk) equals the number of quarts in 100 pounds of milk, ($100 \div 2.15 = 46.51$). Then, $\$2.30 \div 46.5 = \$.049$ or approximately 5c per quart, the selling price of the milk.

Sometimes milk is purchased at so much per pound of butter-fat. In such an instance, the price per 100 pounds will be determined by multiplying 100 pounds of milk by the percentage of butter-fat and multiplying the result by the value per pound of butter-fat. For example: 3.7 per cent milk, butter-fat worth 55 cents per pound ($100 \times .037 = 3.7$, $3.7 \times \$.55 = \$2.035$), the value of 100 pounds of 3.7 per cent milk.

Milk that is sold retail is usually sold by the quart in bottles. (Fig. 33.) To bottle and deliver milk (Fig. 34), requires a larger investment in machinery and bottles, and also takes more labor. If, then, milk is bottled and delivered, the producer is entitled to a higher price than if it is merely put into cans. In most cities, milk sells for 10 cents to 16 cents a quart. Frequently the city ordinances are such that pasteurization* is required unless special care is used in caring for the cows and handling the milk. Proper pasteurization is a safeguard to the public health, and by killing most of the bacteria keeps milk sweet for a longer period.

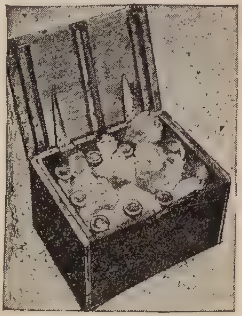

FIG. 34.—Milk bottles may be packed in crushed ice for delivery. (Davis' *Productive Farming.*)

Selling Cream.—When cream is sold, it is necessary to have a cream separator on the farm. This method of disposal of dairy products is suitable for many farms, especially in regions of little dairying. In many localities there is no market demand for whole milk, or whole milk is paid for at the same price as cream. Separating the milk on the farm and selling cream leaves the skim-milk available for feeding to calves, hogs and chickens, for all of which it is a fine feed. Milk should always be handled in a sanitary manner, but not as many precautions are necessary when cream is produced as in the production of whole milk for sale. For market cream or for ice-cream making, cream must be sweet and of fine flavor, free from weed or other undesirable flavors. No poorer quality is needed for butter making; but cream that is sour can be made into butter, while sour cream is not useful for other purposes. A lower price is usually paid for cream for butter making, especially if it is sour. For standard market cream 18 to 20 per cent butter-fat is common, and for whipping cream 33 to 40 per cent. Usually a cream testing not less than 30 per cent is desired for ice cream or for butter. Market cream and cream for the ice-cream trade are usually sold at a fixed price per gallon with a guaranteed test; cream for butter making is usually sold at an agreed price per pound of butter-fat. Creameries are located pretty generally throughout the United States, and where there are no creameries, there are usually cream stations or buyers that will purchase cream for cash. In addition, there are located in many sections of the country creameries to which cream may be shipped direct, the payment being sent by return mail.

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* Pasteurization consists in heating milk or other dairy products to 145 degrees F. for a period of not less than thirty minutes. This treatment kills all the pathogenic (disease-producing) bacteria and about 98 per cent of all other bacteria.

Comparison of Methods of Disposal of Dairy Products.—A comparison of the returns from different methods of selling dairy products may be made, providing an allowance is made for skim-milk for feeding purposes. Probably as a fair average, skim-milk is worth 40 cents per 100 pounds for feeding livestock, such as calves, hogs and poultry. Whey is worth about one-half the value of skim-milk or 20 cents per 100 pounds. A comparison, using purely arbitrary prices, will bring out the returns from different ways of selling milk. In every case considered, the milk is assumed to test 3.7 per cent butter-fat.

1. **Whole Milk, Wholesale,** price $2.10 per 100 pounds, test 3.5 per cent, with a ten-cent differential for each one-tenth of one per cent above or below that percentage. If the test is 3.7 per cent instead of 3.5 per cent, then the amount received for 100 pounds equals $2.10 plus 20 cents or $2.30.

2. **Whole Milk, Retail,** price 10 cents per quart. There are 46.5 quarts in 100 pounds so $.10 × 46.5 = $4.65 received for whole milk.

3. **Market cream** requires 20 per cent butter-fat, and the price is $1.00 per gallon. A gallon of 20 per cent cream weighs 8.45 pounds. In 100 pounds of 3.7 per cent milk, there will be 3.7 pounds of butter-fat. All the butter-fat goes into the cream, so that 3.7 pounds is 20 per cent of the total weight of the cream. Therefore, $3.7 \div .20 = 18.5$, the total pounds of cream; $18.5 \div 8.45 = 2.189$ gallons of 20 per cent cream. Now $2.19 \times \$1.00 = \$2.19$, received for the cream. The milk $100 - 18.5 = 81.5$ pounds of skim-milk left. The skim-milk, $81.5 \times .004 = \$.326$ for skim-milk, or $\$2.19 + .326 = \$2.516$ per 100 pounds of milk when sold as cream.

4. **Cream for Ice Cream.**—For ice-cream making, the test required is 25 per cent and the price is 52 cents per pound of butter-fat. A gallon of 25 per cent cream weighs 8.40 pounds. In 100 pounds of 3.7 per cent

milk there will be 3.7 pounds of butter-fat. Then 3.7 × $.52 = $1.924, for the fat. If 3.7 pounds fat equals 25 per cent, then 3.7 ÷ .25 = 14.8 pounds of cream; 100 − 14.8 = 85.2 (pounds of skim-milk) × $.004 = $.34, value of skim-milk. Finally, $1.92 + .34 = $2.26 per 100 pounds of milk sold as cream.

Job 14. Making and Marketing Butter

Conditions Usually Found.—(1) The production of cream for butter making at central or local factories is the most popular form of dairying in some sections. (2) Many such dairymen are members of coöperative creamery associations.

Aims.—(1) The preparation of cream for butter making should be understood. (2) Conditions and methods for making good butter should be understood by the students.

Problems for Study and Discussion.—(1) How many dairymen in your region produce cream for butter making?

2. To what extent is the butter-fat produced in your region (a) made into butter at home (b) manufactured at a local factory (c) shipped to a central factory?
3. Debate making butter at home vs. selling butter-fat to factory.
4. Debate selling butter-fat to factory vs. selling cream at wholesale.
5. Ask a number of farmers how much butter-fat they produce per month; estimate the quantity for your region.
6. At present prices find what would be the income per herd from sale of butter-fat.
7. Compare the average income per cow on several farms.
8. Describe methods of handling cream before shipment or delivery to factory.
9. Why do some factories require sweet cream for butter making?
10. Give the steps in making good butter.
11. Ask merchants to compare the prices for average home-made butter with prices of creamery butter.
12. Find what uses are made of the skim-milk and buttermilk in regions where butter is manufactured.

Activities.—(1) Practise making butter or assist a butter maker at a factory. (2) Practise weighing and sampling cream at a factory or at home. (3) Operate a hand separator, learning its construction and adjustments.

Making Creamery Butter.—A great deal of the butter made in America is manufactured in coöperative creameries from cream brought to the factories direct from dairy farms. Some of the cream is shipped on trains. Large centralized companies are found in some states buying cream from dairymen far and near. Formerly some of the factories received whole milk from dairymen and ran separators, but home separators are now more commonly in use and have largely replaced the old plan. The farmer now has to hold or ship cream only, and usually does not take back any skim-milk or buttermilk from his factory to his farm. Tuberculosis is therefore not spread through skim-milk from one farm to another. The dairyman is required to go to the factory less frequently. Cream-gathering trucks or wagons go from farm to farm collecting cans of cream, in many of the intensive dairy regions.

Home Butter Making.—Many farmers run small churns in their farm dairies (Fig. 35). The products vary widely in quality. A few produce high-grade creamery butter from their own herds and purchase some cream from neighbors. In far too many home dairies, butter of very inferior quality is made and sold on the market as dairy butter. Much of this is purchased by country and village stores at low prices, allowed to become rancid, and shipped in barrels to renovators. In contrast with this appalling waste we find some dairymen making dairy butter and selling it at fancy prices to individual customers because of its high quality.

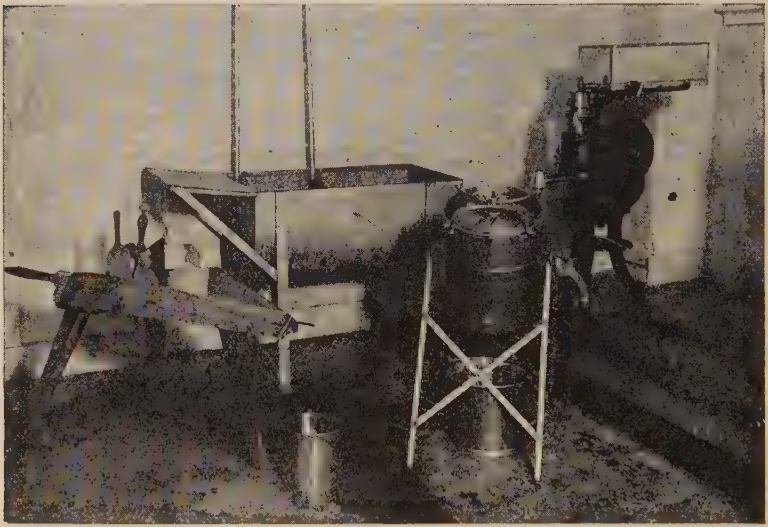

Fig. 35.—Butter-making room in a farm dairy. (After Washburn, *Productive Dairying.*)

Overrun.—The overrun is the difference between the weight of butter produced by churning and the weight of the butter-fat in the cream used. The careful butter maker tries to keep the overrun between twenty and twenty-five per cent. This overrun consists of water, salt, and curd. Butter is made up of the following ingredients for 100 pounds: fat, 82.5; water, 15.5; salt, 1.5; curd and other ingredients, 0.5.

The overrun in large coöperative butter factories is usually sufficient to pay all costs of operating the factory so that dairymen can receive for their butter-fat as much per pound as the butter brings in the market.

Cream separators are used on the farm for skimming milk when it is freshly drawn from cows. They are run by hand or some light power, such as a small motor or a treadmill. Large separators are used at butter and cheese factories and are commonly driven by steam turbine or electric motors. The separator may be adjusted to skim the milk of any consistency desired from very thin to very thick cream.

Cooling and Holding Cream.—Most cream sold to butter factories is held in cans set in cold water until time for delivery. It should be cooled after separation and the cans should not be closed. Sweet cream should not be added to old or sour. Stir the cream every morning and evening during the holding period. This allows gases to escape which would make cream bitter or "off flavor."

If cream must be delivered sweet to the factory it should be delivered in the cool morning hours, and in warm weather, troughs for holding the night's cream should contain ice water.

A modern butter factory is equipped with scales for weighing cans of milk as received. The cream is poured from farmers' cans into a weighing can and a sample is taken to be tested. The dairyman receives pay for the number of pounds of butter-fat delivered, not for the quantity of cream. If a farmer delivers a hundred pounds of cream testing 30 per cent, he will be paid for thirty pounds of butter-fat. The cream is taken from the weighing cans to a large storage vat. Different grades of cream, determined by acid test, sour taste, and odor, are usually placed in separate vats. Cream is usually pasteurized and then ripened and churned into butter. Large churns, cream pumps, and buttermilk vats are handily placed in the factory. A cold-storage room or refrigerator is used for holding butter after it is made until marketed.

Butter Prices.—Prices of home-made dairy butter and of creamery butter differ widely. Creamery butter usually sells for more than home-made dairy butter. This is because it is put up in standard quality, standard prints, or standard containers, and buyers know better what they are buying.

Selling to Creamery vs. Selling Whole Milk.—For this purpose, the cream should have 30 per cent butter-fat and is worth 46 cents per pound of fat. Thirty per cent cream weighs 8.35 pounds per gallon. In 100 pounds of 3.7 per cent milk, there are 3.7 pounds of butter-fat; $3.7 \times \$.46 = \$1.702$ for the butter-fat in the cream. The 30 per cent cream contains all the fat, therefore, $3.7 \div .30 = 12.33$ pounds of cream. The milk, $100 - 12.33 = 87.67$ pounds of skim-milk. Then $87.67 \times .004 = \$.35$ the value of the skim-milk and $\$1.70 + \$.35 = \$2.05$, the value of 100 pounds of milk sold as cream.

Home Butter Making vs. Selling Whole Milk.—Comparing home butter making with other methods of disposing of milk would give figures as follows: Farm butter is worth $.45 per pound. In 100 pounds of 3.7 per cent milk there are 3.7 pounds of butter-fat. In churning butter efficiently, an overrun of from 20 per cent to 24 per cent may be obtained, which is composed of water, salt and curd. Supposing the overrun to be 20 per cent, then 3.7 × .20 = .74 pounds of overrun. Then 3.7 + .74 = 4.44 pounds of butter and 4.44 × $.45 = $1.998 received for the butter. In addition, there would be the skim-milk. Suppose that 30 per cent cream were churned, then there would be 87.67 pounds of skim-milk and 87.67 × $.004 = $.35 for skim-milk. Besides this, there would be approximately 7.89 pounds of buttermilk. (The pounds of cream 12.33 − the pounds of butter 4.44.) The buttermilk is worth for feeding purposes approximately half as much as skim-milk, so 7.89 × $.002 = $.1478. Then $2.00 + $.35 + $.15 = $2.50 received for milk churned and sold as butter.

Job 15. Making and Marketing Cheese

Conditions Usually Found.—(1) Cheese factories are usually confined to limited areas and are less widely distributed than butter factories. (2) Cottage cheese is made on many farms for local sale or home consumption. (3) Recently special types of cheese factories have been started in new regions.

Aims.—(1) Students should learn the problems of dairy farming in cheese-factory regions. (2) They should understand some methods of making cheese.

Problems for Study and Discussion.—(1) What are the leading cheese-factory regions of America?

2. What is American cheddar cheese?
3. What is cottage cheese?
4. What is meant by full cream cheese?
5. What by-products are left for feeding to livestock in cheese-making communities?
6. What is whey butter?
7. Compare the feeding values of whey and skim-milk for calves and pigs.
8. Compare the selling of cream for cheese with the selling of market milk at wholesale.

Activities.—(1) Make several batches of cottage cheese for home use or for sale. Salt and flavor to suit conditions. (2) Make other types of cheese if conditions will permit.

Cheese Making in America.—Several European countries make many more kinds of cheese than are produced in America. The kinds sold in America may number one hundred or more. By far the most popular type of factory cheese is known as American or cheddar cheese. American cheese may be kept for several months. It is of two general types: (1) "full cream cheese," made from whole milk without removing the cream; (2) skim-milk cheese or skim cheese made from skim-milk in factories which use the cream for butter making. These two forms of cheese are most commonly found in grocery stores throughout the country.

The leading state in the production of cheese is Wisconsin. Cheese making is largely confined to the cooler parts of the country, but has extended along the high altitudes as far south as North Carolina, Virginia and Tennessee.

Cottage Cheese.—The most popular form of home-made cheese is called cottage cheese, which is usually made from clabbered skim-milk and sometimes from buttermilk. This is done by gently heating the milk and straining off the whey. It is then salted and otherwise flavored to suit the family or the market. Recently large quantities have been produced by factories and put up for market in paper cartons for sale by market wagons and grocers. This product must be used while nearly fresh (Fig. 36).

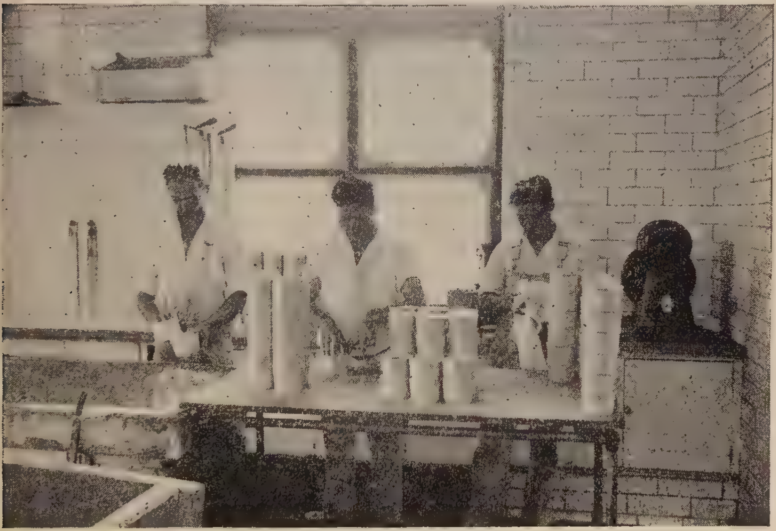

Fig. 36.—Students packing cottage cheese in waxed-paper cartons for immediate sale in markets. (Nebraska Station.)

Whey vs. Skim-Milk.—Experimental trials have proved the value of skim-milk to be nearly double that of whey. Whey from cheese factories contains some albumen and mineral matter and considerable sugar. Its feeding value for swine causes the nearby farmers to use it for feeding purposes. Whey is more watery than skim-milk, containing about 6 to 7 per cent of dry matter. When full cream cheese is made from whole milk much of the butter-fat is likely to be lost in the whey. In this case the quality of the whey for feeding purposes is higher. Many cheese factories run the whey through a separator and churn whey butter. The whey left from this process is extremely low in feeding value.

Milk for Cheese vs. Market Milk.—Butter-fat is worth 49 cents per pound. In 100 pounds of 3.7 per cent milk there are 3.7 pounds of butter-fat; 3.7 × $.49 = $1.813. From 100 pounds of 3.7 per cent milk, there should be produced 10 pounds of cheese, so if there were no losses, there should be 90 pounds of whey left. Usually the whey is returned to the patron, then 90 × $.002 = $.18, the value of the whey, and $1.81 + .18 = $1.99, the value of the milk for cheese making. Sometimes milk for cheese making is bought on the basis of the number of pounds of cheese made from the milk.

Reference Books on Dairying.—Eckles (Macmillan); Judkins (Wiley); Ladd (Macmillan); Washburn (Lippincott); Yapp and Nevens (Wiley).

Things to Make in Dairy Projects.—Hay rack, feeding racks for young stock, erect needed buildings, paint buildings, install ventilators, feed chutes, feed cart or carrier, milk-sheet board, milking stools, install milking machines, milk-can cooling trough, calf stanchion (Fig. 18), pasture shelters, mend utensils, repair dairy equipment and machinery, install new equipment, install concrete floors, make walks between buildings, build or repair fences.

BEEF ENTERPRISE

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Analysis into Jobs.—The following eighteen jobs include the chief teaching operations in the beef enterprise. References are to numbers of U. S. Farmers' Bulletins. See also *Beef Cattle* by Snapp.

1. Determining possibilities in the beef enterprise. Bul. 612, 1073, 1379, 1395.
2. Choosing the beef breed. Bul. 993, 1068.
3. Selecting breeding stock. Bul. 993, 1068.
4. Planning barns, shelters, and equipment. Bul. 825, 855, 1214.
5. Deciding what crops to grow.
6. Increasing the carrying capacity of permanent pastures. Bul. 1428.
7. Buying concentrates and supplementary feeds.
8. Attending to registration of animals.
9. Caring for and managing the herd.
10. Detecting and preventing disease. Bul. 909, 1017.
11. Producing baby beef. Bul. 1073, 1135.
12. Showing and selling breeding stock.
13. Wintering calves, yearlings, and breeding animals.
14. Buying feeder steers.
15. Feeding beef cattle for market. Bul. 1416.
16. Marketing cattle for beef. Bul. 1144.
17. Butchering and running beef ring. Bul. 1415.
18. Keeping records. Bul. 511, 572, 782, 1182.

Job 1. Determining Possibilities in the Beef Enterprise

Conditions Usually Found.—(1) In areas where land is high in value, beef cattle are usually raised on farms having rough or rolling pasture land. (2) Many beef cattle are grown on low-priced land in arid and semi-arid sections of the United States. (3) On many other farms throughout the entire United States there are found one or several beef cows and calves.

Aims.—Students should know the conditions favorable and unfavorable for raising beef cattle on a given farm.

Problems for Study and Discussion.—(1) What class of cattle, dairy or beef, are most commonly kept on the farms in your locality? How may this govern your entry into the beef-cattle business?

2. What plans should be made for selling the cattle you may have, either as calves, yearlings, feeder steers, slaughter steers, or as breeding stock?
3. Give several reasons why any one plan just mentioned is adapted to the farm of average size—say 160 acres.
4. What should be, and how may you determine, the balance between grain, forage, and pasture crops where beef cattle are to be grown?

5. What additional knowledge and skill should one have for entering the pure-bred cattle business, as compared with the raising of grade beef cattle?
6. Mention the local possibilities in financing the livestock and equipment needed in the raising of beef cattle.
7. Find what prices have been received in your region during the past four years for different classes and grades of beef cattle. Tabulate results of class inquiry.
8. Compare the number of beef cattle per farm in your district or township with the number per farm for the whole state.

Activities.—(1) Make a wall chart with three columns, the first showing the factors involved in determining upon this enterprise, the second showing the favorable, and the third the unfavorable local conditions. (2) Make another chart showing the number of beef cattle for each of ten to twenty farms with the acres for pasture and acres for grain and acres for hay in each case.

The Cattle That are Raised in the Community.—This condition should be considered when deciding to enter the beef-cattle business. If beef cattle are grown, there must be a market for breeding stock. There will be cattle to sell from other farms if a few are needed to fill out carloads. Coöperative buying and selling can be carried out. An exchange of bulls may occur in some instances, saving to the community valuable sires that have become too closely related to their herds. If one attempts to raise beef cattle in a dairy-cattle community, there will be isolation in many ways. One will be forced to go outside his own community to buy and sell. There will be many other disadvantages.

The Size of Farm Available.—This factor will vary. In raising beef cattle, one should plan on a farm and equipment large enough to feed an occasional load of cattle for market if prices appear to justify. There may be times when prices show it advisable to sell the cattle as stockers or feeders and also sell the grain that is raised. In the corn belt proper, a farm of one hundred acres is perhaps the minimum, while in the great plains area, a farm of three hundred and twenty acres may be the minimum size. Many feeders raise at least 60 per cent of the grain fed on their farms.

The Condition of Fences and Buildings.—The fences need to be in such condition that no great outlay of expense or labor is needed in order that one may enter at once upon the business of raising beef cattle. Certain areas should be fenced hog-tight. The buildings should be in good condition and of adequate size to house the stock and to hold the grain, hay, etc., that is grown or purchased. If the fences and buildings are not in a usable condition, the actual entry into the beef-cattle business should be deferred until the needed repairs can be made. Contract labor can erect the buildings and fences in a comparatively brief time. It is, however, much more economical for the farmer to do as much of this labor himself as is possible, even though it takes a longer period of time.

The Amount of Pasture Land.—By this we mean permanent pasture. At least one-fourth of the area of the farm should be in permanent pasture, with additional acres for hay and annual forage crops. If the farm in question does not have the right amount of pasture, it may take one or more years of crop rotation to get pastures established.

Personal Finances and Advisability of Securing Loans.—Either the land or the equipment, such as livestock, feeds, teams, etc., should be largely paid for. Beef cattle are considered as a first class security and a mortgage is often given on the animals themselves for a part of their purchase price. The reputation of the borrower will in a large measure determine the size of the loan that may be secured. The person who is raising beef cattle has an opportunity to grow into the business gradually and not be forced to borrow large amounts at any given time.

Character and Length of Lease.—In order to carry on successfully the raising of beef cattle, one should ask for at least a five-year lease. Any period of rental less than this makes it unwise for the operator to plan any considerable expenditure of money. The stock-share lease is perhaps the best form of a lease for the beginner who does not own a farm. The cultivated land may be rented for cash. The pasture and the livestock are handled on a partnership basis. The owner of the livestock retains the managerial control and balances his investment in these against the labor, teams and equipment of the renter.

Shipping and Railroad Facilities.—Beef cattle can perhaps be transported longer distances to market than can any other commodity. For this reason, they are often reared many miles from a railway station. It is the service that can be had after the cattle are loaded in the cars that is important. Branch lines and transfers to foreign railway lines are expensive in rate and time. The desirable situation is to ship from a main-line point, or at least to ship over the same railway system for the entire distance.

Distance to Haul the Additional Feeds.—One should count on having to buy extra feed at times. The distance this must be hauled is an item to consider. With the use of motor trucks, this problem resolves itself into a question of good roads. Before the advent of motor trucks, it was a common sight in the great plains area to see one driver handling four or six mules and pulling two loaded wagons to some ranch or farm forty miles from the railway station.

Job 2. Choosing the Beef Breed

Conditions Usually Found.—(1) The majority of beef cattle are grade rather than pure-bred, being from a pure-bred sire and a grade dam. (2) Some breeds show marked ability to endure the rigors of cold winter weather, or to adapt themselves to range pasture conditions. (3) Many breeders prefer cattle that have a quiet gentle disposition or temperament. (4) Polled cattle are gaining in popularity.

Aims.—Students and breeders should know the desirable type of a good beef animal. They should be able to compare the different breeds with this type and to determine their respective values.

Problems for Study and Discussion.—(1) Enumerate the number of cattle, pure and grade, of each breed in your neighborhood.

2. Name the different breeds of beef cattle.
3. Which breeds have dual-purpose strains, i.e. produce milk above the needs of the calf?
4. Which breeds are adapted only to beef production?
5. In what way may the disposition of the breed enter into the choice?
6. Give the principal body markings of the different beef breeds. Give other characteristics.
7. What are the advantages to be derived where a community is given over largely to the growing of beef cattle?
8. What favorable arguments are advanced by the owners in favor of polled cattle?

Activities.—(1) Collect pictures of good animals of each of the beef breeds. Mount these on placards for use in the school room or at home. (2) Make a wall chart listing the special beef and dual-purpose breeds in one column. (3) Give the advantages of each at the right. (4) Collect data regarding prices at private and public sales for different breeds. Tabulate these on a chart for calves, for cows, for bulls.

Field Trip.—Visit the representative breeds found in the locality. Ask the owner of each to tell why he prefers his certain breed. Debate these claims when returning from trip.

Personal Preference.—The choice of a breed is largely personal preference. This preference may be influenced largely by contact and experience. Many times the father has handled a certain breed of cattle and the son continues to carry on that work. Economic conditions, such as increase in population or increase in the selling price of land, may cause the farmer to change breeds of cattle and also to change his type of farming. There are five principal breeds of beef cattle, with the polled strain coming off from two, making a total of seven. Among the breeds there is some variation in size and form, but from the butcher's standpoint, the variation in dressing percentage is very small.

Type.—The desirable type of beef animal is a blocky form with short legs. The shoulders should be wide at the top; the chest deep and the heart girth large; the back and loin wide, with this even width carried well to the rear of the rump; the thighs well filled and extending downward nearly to the hock joint. The under-line should be straight. The head and legs of the animal should be of good size and should indicate vigor, but should not be so large as to appear coarse.

Shorthorns.—These cattle are perhaps the most popular and widely distributed breed of beef cattle in the United States. In size they are among the largest. They are of a quiet disposition, being easily controlled at the halter or in the feed lot or pasture. In color they are red, roan, and white (Figs. 37, 38, 39, 40). The red are usually partly white, or sometimes red and roan. The Shorthorn as a breed has horns. The Polled Shorthorn is an offshoot, or variation from the parent type, that does not have horns. In characteristics the Polled Shorthorn resembles the Shorthorn. The milking Shorthorns are a strain of cattle that produce a good type of beef animal and at the same time give a good flow of milk

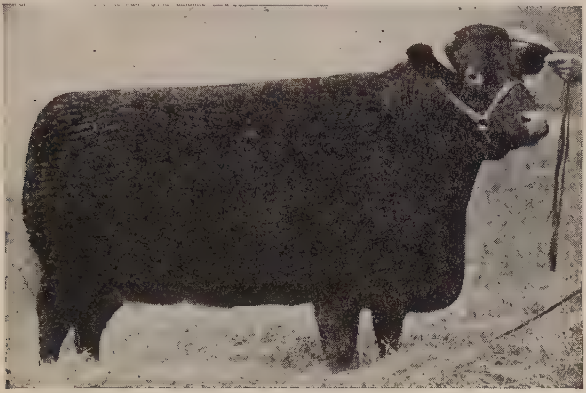


Fig. 37. —Goldie's Princess, shorthorn cow. (Am. Shorthorn Breeders' Assn.)

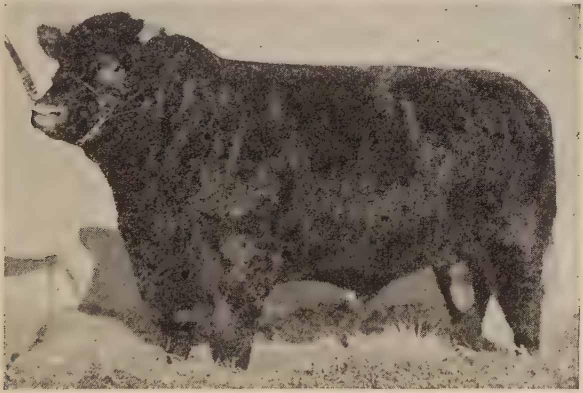
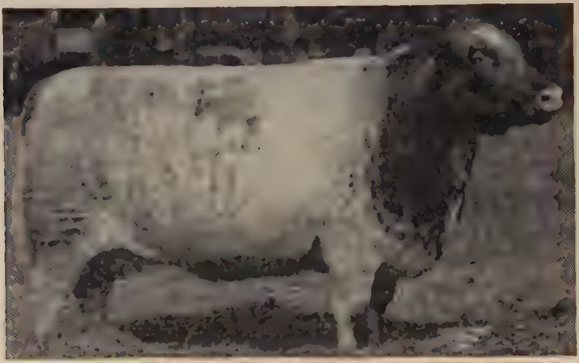


Fig. 38.—Shorthorn red bull, Ballytin Rodney. (Am. Shorthorn Breeders' Assn.)

at the pail. (Fig. 1.) They are a popular small-farm breed for this reason. The producing of both beef and milk in large quantities is the reason for the Shorthorns being called a dual-purpose breed.

Hereford cattle as a breed rank second to Shorthorns in the three characteristics of number, popularity and size. The color is dark red, with white face, throat, brisket and body undermarkings, including white legs and brush of tail (Figs. 41 and 42). This breed presents a very uniform appearance. The white face is said to be "dominant"—that is, it will appear in any first-generation cross with a pure-bred Hereford bull. Their disposition depends upon the manner in which they are handled. They may be taught to be quiet under the halter, or they may become rather wild and easily excited under range conditions. The breeders of Hereford cattle make the claim that they show unusual ability to "rustle" for their living. They will subsist where other breeds fail under con-



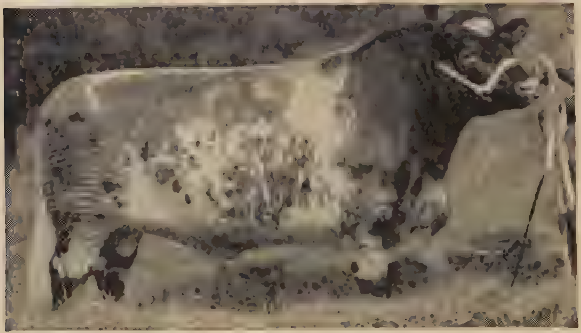
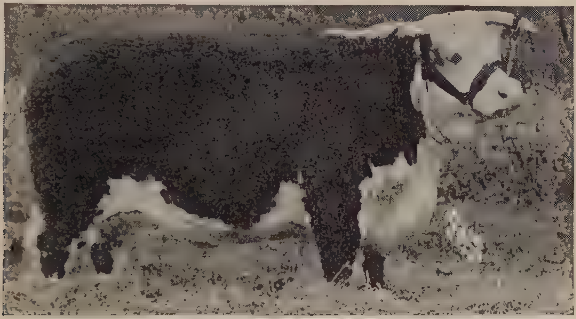


FIG. 39.—Gloster Princess 41st, grand champion polled shorthorn female, Iowa State Fair. (Am. Shorthorn Breeders' Assn.)

FIG. 40.—Mardale Senior, grand champion polled shorthorn bull at International. (Am. Shorthorn Breeders' Assn.)

ditions of short grass, wide range and little shelter. The cows usually give enough milk to raise good strong vigorous calves but as a rule do not give any excess or continue in milk after calves are weaned.

Polled Herefords (Figs. 43 and 44) have been developed from a few hornless animals. Their characteristics are now similar in other respects to those of the parent breed.



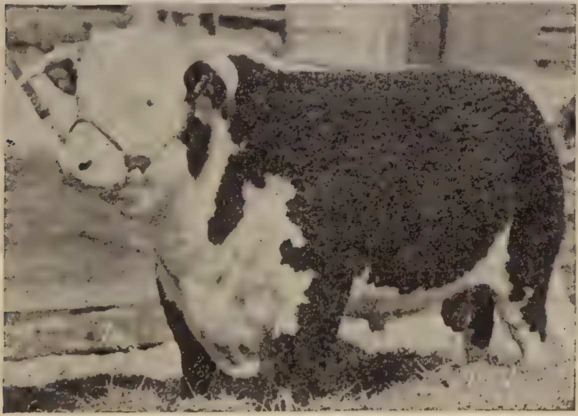
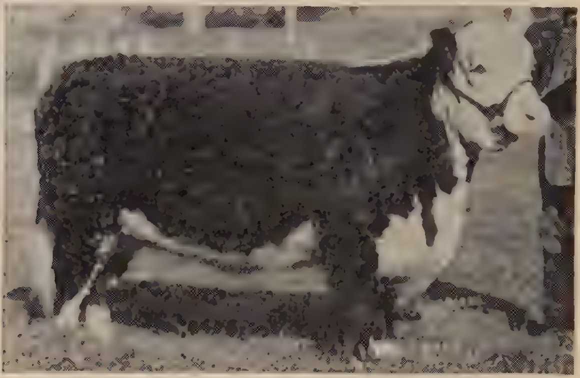


Fig. 41—A good type Hereford cow. (Am. Hereford Cattle Breeders' Assn.)

Fig. 42.—Grand champion Hereford bull. (Am. Hereford Cattle Breeders' Assn.)

The Aberdeen Angus is a very popular breed of beef cattle. The type is blocky, compact and very smoothly finished (Figs. 45 and 46). Their dressing percentage is perhaps the highest of any. They are solid black, with short hair. Like the white-face characteristic of the Hereford, the polled head and black color are practically always dominant in any first-generation cross with a pure-bred Aberdeen Angus bull. In size they closely resemble the Hereford and Shorthorn. The cows give enough milk to raise the calves, but very little in excess. In disposition they are inclined to be wild and easily excited under range and pasture conditions, but the Scotch call them "doddies" because they are so docile when properly managed.



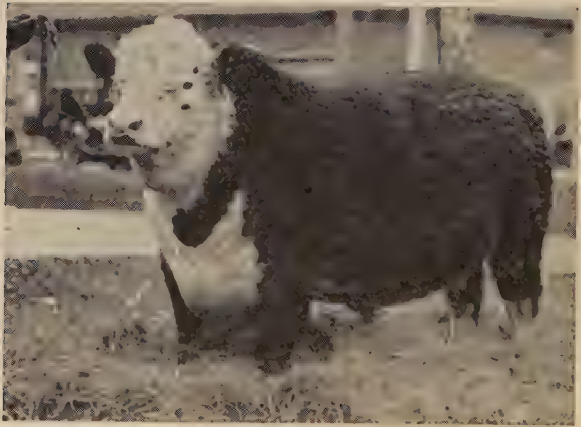
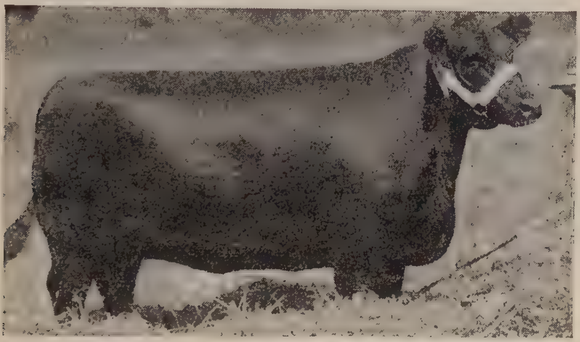


FIG. 43.—Miss Donald Gem, grand champion polled Hereford female. (Am. Polled Hereford Breeders' Assn.)

FIG. 44.—Prime Mischief, grand champion, polled Hereford bull. (Am. Polled Hereford Breeders' Assn.)

The Galloway is a breed of beef cattle showing considerable resemblance to the Angus. They are polled and black (Fig. 51). Their hair is long and rough, which accounts in part for their ability to endure the rigors of the cold Scotch climate from which they came. They are smaller in size than the Herefords, Shorthorns or Angus. Their disposition is similar to that of the Angus. The cows are not exceptional milkers. They are not classed as a dual-purpose breed.

The Red Polled is a dual-purpose breed of cattle. The cows give a good quantity of milk and also produce calves that develop into good beef animals. They are solid red in color (Figs. 47 and 48). They are evenly but more thinly fleshed than the other beef breeds, thus presenting a less blocky appearance. They fatten easily into good beef animals. In disposition they are quiet and gentle. Their heads are smooth and polled.



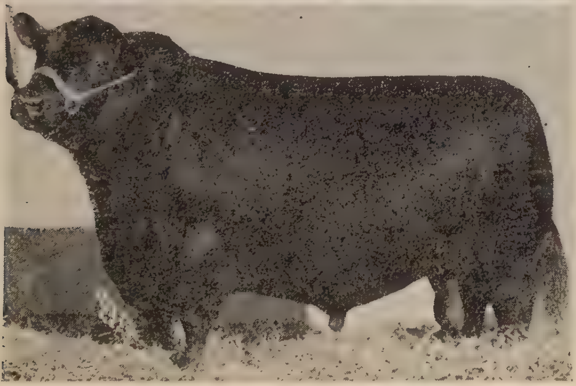
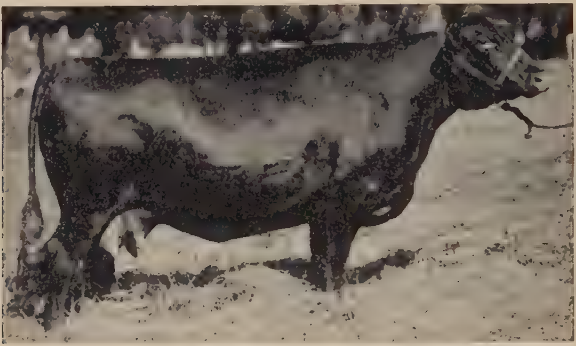


Fig. 45.—Miss Burgess 5th, grand champion, Aberdeen Angus female, International. (Am. Aberdeen Angus Breeders' Assn.)

Fig. 46.—Playman of Sunbeam, grand champion, Aberdeen Angus Bull. International Livestock Exposition. (Am. Aberdeen Angus Breeders' Assn.)

Brown Swiss cattle may be classed as a dual-purpose breed. They carry considerable weight. (Fig. 2). Bulls may weigh as much as 1800 pounds and cows as much as 1430. In form they are blocky and thickly fleshed, with large head and neck. In quality they are below medium. Their temperament is quiet. Dark brown and gray are popular colors, although they may vary from light brown to light gray. There is usually a stripe of lighter color extending from withers to tail. The muzzle should be lead colored.



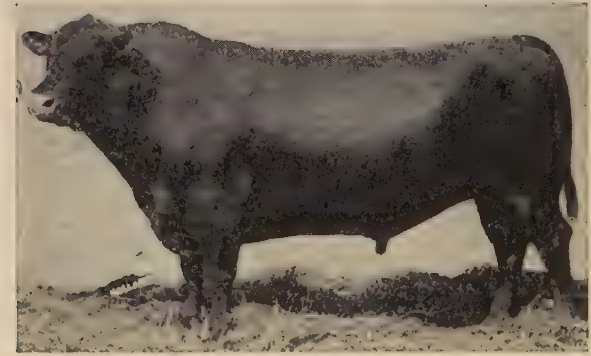


FIG. 47.—Sally, champion Red Polled cow, South Dakota and Iowa State Fairs. (Red Polled Cattle Club of Am.)

FIG. 48.—Royal Dude, senior champion, Red Polled bull, International (Red Polled Cattle Club of Am.)

Average Weights of Cattle in Show Condition

	Aged bulls	Aged cows	2 yr. bulls	2 yr. heifers
Shorthorn	2224	1730	1917	1530
Hereford	2238	1689	1911	1517
Angus	2064	1641	1867	1425
Galloway[1]	1900	1400	1600	
Red Polled [1]	1925	1375		
Brown Swiss[1]	1800	1430		

[1] Approximate.

Early Use—Cattle have been used for many centuries as a means of producing milk and meat and as a means of providing motive power. So long as the animals were used for these purposes, no special progress or improvement was noted. With the extended use of the horse as a form of motive power, the selection and breeding of cattle for a specific purpose began. This resulted in separate breeds of cattle for beef and for milk production.

Developing the Breed.—In the history of development of each breed of cattle, we find a few men who have stood out as leaders in the work of improvement. These men are sometimes spoken of as founders of their respective breeds, but such is not usually the case. Their task was to take the native cattle and improve upon them. The greatest period of development was between the years of 1750 and 1850. The first mention of specific breeds of cattle dates back in some instances much farther. Malin places the early mention of different breeds as follows: Angus cattle in 1523; Herefords in 1627; Shorthorns in 1783. Plumb records the early mention of breeds: Red Polled cattle in 1734; Angus in 1797; Polled Shorthorn in 1873; and Polled Hereford in 1898.

Job 3. Selecting Breeding Stock

Conditions Usually Found.—(1) Breeding animals are selected on the basis of the theory that "like begets like." (2) Breeders usually realize that a pure-bred bull, when crossed with a grade cow of the same or another breed, will impress his qualities upon the offspring. (3) Breeders usually select breeding animals of the type which they wish the offspring to possess. (4) Some breeders allow price to influence them too much when selecting breeding cattle.

Aims.—(1) Young farmers should know the desirable type of a pure-bred beef animal. (2) They should observe the small variations between different individuals. (3) They should become skilful in detecting strong and weak points in individuals.

Problems for Study and Discussion.—(1) Ask your neighbors regarding the purity of blood of their beef cows; bulls.

2. Which farmer has cattle of greatest purity? Best quality? Give your reasons.
3. Describe the general appearance of a beef animal.
4. In what body parts will the choice steer show superiority over the common steer?
5. Mention the relative importance of cost price, form, constitution, registration, in selecting the females to start a herd.
6. What should the regular breeder do with the heifer calves?
7. How may selection of the individuals affect the percentage of calves raised?
8. What are the factors which affect prices to be paid for breeding stock?
9. Mention several plans that may be followed in starting the business of raising beef cattle?
10. What are the advantages of coöperative ownership of bulls?
11. What is the best age at which to buy a bull?
12. State the relative merits of buying at fairs, auction sales, and privately.

Activities.—(1) Practise judging beef cattle of each of the breeds found locally (Figs. 49, 50, 51.) Do this at first with a score card and afterwards by the placement method, as at a fair. (2) Draw up regulation rules for forming a coöperative bull association for your community. (3) Practise detecting the ages of cattle.

(4) Collect sale catalogs showing pedigrees of pure-breds. From these choose animals which can be readily compared and rank them according to blood merits.

Individual Judgment Needed.—The selecting of breeding animals offers a chance for the exercise of the best judgment and for laying the foundation for future success in raising beef cattle. The practice we get in judging is usually with fat animals prepared for the show ring, or with highly finished animals prepared for sale purposes. Practice should also include animals that cannot be handled, and animals in ordinary flesh that have to be viewed from on horse-back. The ability to tell what the animal will develop into is just as valuable as the ability to judge a finished individual (Figs. 49, 50, 51).

Fig. 49.—Practice in placing animals of the same class is good judging work for the winter.

Fig. 50.—Students in vocational agriculture studying shorthorn cattle.

Fig. 51.—Students judging Galloway cattle near Indianola, Iowa. (C. F. Sarli.)

A Beef-Calf Project.—One or more heifer calves make a good individual project for a boy in vocational agriculture, if they are selected with the thought of being the beginning of a herd. Corn and oats projects for the second year with the heifers as a continuation project is a suitable combination.

Each student should make a study of a number of calves and herds in the local community for practice in selecting good animals. Usually much of this judging is done before the animals for the project are selected.

The ultimate object in selecting breeding stock is to produce beef for human food. The fat steer, two or three years old, stands superior to heifers, cows or veal as a form of finished beef. For that reason, a score card of the fat steer is given as a means of introducing the subject of judging beef cattle. The student should become familiar

Fat-Steer Score Card

SCALE OF POINTS	PERFECT SCORE
GENERAL APPEARANCE—49 points:	
1. WEIGHT: score according to age, estimate weight:	
6 months .... 450 pounds	
12 months .... 850 pounds	
18 months .... 1100 pounds	
24 months .... 1300 pounds	
30 months .... 1475 pounds	9
2. FORM: straight topline and underline, deep, broad, low-set, compact, symmetrical, stylish not paunchy	10
3. QUALITY: hair soft and glossy; hide pliable; bone, head and horns fine; body and fleshing smooth and even; neither rolly nor patchy	10
4. CONDITION: degree of fatness, indicated by spinal covering, rib covering, and fullness of purse, flank and tongue root, proper texture and finish indicated by a mellow yet firm and springy touch	10
5. DRESSING PERCENTAGE: high condition, trim middle, thin hide, good quality	10
HEAD AND NECK—5 points:	
6. MUZZLE: broad, nostrils large	½
7. EYES: large, clear, quiet expression	½
8. FACE: short, clean cut	½
9. FOREHEAD: broad	½
10. EARS: medium size, fine texture	½
11. HORNS: fine texture, medium size, well shaped	½
12. NECK: short, thick, throat clean	2
FOREQUARTERS—9 points:	
13. SHOULDER VEIN: full, plump	2
14. SHOULDER: well covered with flesh, compact on top, smooth	5
15. BRISKET: wide, neat and trim	1
16. LEGS: straight, wide apart, short arm full, shank fine	1
BODY—23 points:	
17. CHEST: deep, wide, crops full	5
18. RIBS: long, well arched, broad across top, covered with thick, smooth, firm flesh	8
19. LOIN: broad, covered with thick, smooth flesh	9
20. FLANK: full, even with underline	1
HINDQUARTERS—14 points:	
21. HOOKS: well laid in and smoothly covered	1
22. RUMP: long, wide, level, smooth at tail head, pin bones not prominent, far apart	4
23. THIGHS: plump, deep, wide and thick	5
24. TWIST: deep, plump	3
25. LEGS: straight, short, shank fine	1
TOTAL	100

with the desired type, the relative importance of the different parts, and the terminology. The use of a score card helps the student to analyze and classify the parts of the animal so that a selection on a comparative basis can be made later.

General Appearance.—In general appearance the male animals, above one year of age, should show increased size and weight as compared with females. The desired masculine characteristics are bright eyes, larger head, heavy development over the neck and shoulders, wide distance between the fore legs, and well-developed brisket. All weights in preceding jobs. The females should show a more quiet disposition with refinement about the head, neck and forequarters. They should not show additional growth of hair about the head and neck as do the males. Females two years old and over should show mammary development suited to their class. The dual-purpose cow should approach the dairy cow in size of udder and development of milk veins. The beef-type cow may show a rather small udder with less development of milk veins than the dual-purpose type.

Other Characteristics.—Trueness to type, quality of hair, constitution, and vigor, are characteristics that will show in either thin or fat animals. They are points that every breeding animal, male or female, should possess. The broad muzzle, wide-awake look in the eye, wide chest and deep heart girth are indications of constitution and vigor. Quality will be indicated in the hair and legs. Trueness to type will take in such points as color, form and size.

Keep Best Heifers.—Each year the breeder should keep a few of the best heifers to replace the old and barren cows. A cow should be a regular breeder; that is, should produce a calf each year; otherwise the percentage of calves may be too low for the best profit. A heifer should produce her first calf at from 24 to 27 months of age. The gestation period is 283 days.

Price.—In selecting breeding animals, you should get the best individuals possible for the money you have to put into the purchase. Breeders can perhaps afford to pay two or three times the market price for the right kind of individual. It is the exceptional breeder of purebred cattle who can afford to pay from one to four thousand dollars for a bull. Under such conditions the breeder considers the advertising value which an animal of that price will bring to his herd.

There may be conditions under which it is wise to buy grade cows or inferior cows, but it is poor economy to buy an inferior bull. A good bull is one-half of the herd, and little progress is made by using a cheap individual.

A herd may be started by buying a single good cow and breeding her to a neighbor's good bull. If the heifer calves are kept as breeding animals, one can in a few years build up a small herd. Another way may be to purchase a small interest in an already existing herd, such as renting a farm on the stock-share lease and purchasing an interest in the beef cattle.

Coöperative Bull Associations.—The experience of coöperative bull associations shows this plan to be well adapted to farmers having small herds of cows. Usually from three to six farmers, depending upon the number of cows kept by each, join together in the purchase of a bull. The association sometimes includes as many as five groups or blocks of farmers and owns five bulls. Each individual farmer then owns a share in each of the five bulls.

The value of a good bull is to be found in the quality and production of the offspring. Calves from grade cows and a pure-bred bull can never be registered, but the value of these calves is so much greater than that of scrubs that there is no question as to the advisability of using a pure-bred bull. Coöperative ownership may be the only means of providing this improvement. A mature bull can serve as many as 50 or 60 cows, and should be kept on a farm conveniently located. (See U. S. Farmers' Bulletin 993.)

Disease Control.—Two prominent communicable diseases, tuberculosis and contagious abortion, can in a large measure be controlled by coöperative ownership of bulls. Such an organization can deny the service of the bulls on cows infected with such diseases. The educational value of such an organization will cause the members to be alert in keeping away the infected cows, testing each cow in the organization, and eliminating any possible reactors.

Eliminating the Scrub.—Farmers can coöperate in buying a good bull and be at no greater individual expense than for each to own a scrub bull. The purchase price will not be materially greater and the cost of keeping will be much less. The plan will provide for fewer and better bulls.

Community Breeding Attracts Buyers.—A buyer in search of good individuals of a given breed will go to a community having a reputation for producing such cattle. It is difficult for a single individual to attract large buyers, even though his cattle may be superior in quality. Uniformity in age, quality and appearance can be achieved under the coöperative ownership of bulls.

Age of Bulls to Buy.—One advantage in buying an aged bull lies in the opportunity to judge the prepotency of the animal. This animal may have become related to the cows in a given herd and the owner may therefore be willing to sell at a reasonable figure. The aged bull sometimes becomes cross and dangerous to handle. If so, an element of personal risk is involved and should be considered by the purchaser. Perhaps dehorning will help to remedy this objection.

Purchased at the age of two years, the bull is ready for immediate service and the cost of keeping is lessened. One also has the advantage of near maturity and can judge quite accurately as to the type into which the animal will develop. The one-year-old bull offers the advantage of a lower purchase price, and an opportunity to train and develop the animal as desired. The cost of keeping is increased and one can only estimate the possible development and type.

Auction Sales vs. Private Buying.—Regardless of the place of buying, whether auction sale, exhibit room, or home farm, the buyer should study the individual animal closely. The sire and dam, together with the lines of breeding shown in their pedigree, should be examined. One should know the principal families of the breed, in order to avoid inbreeding, or to practise line breeding. The show animal will look the best because of being in the height of condition. Preparation for the show ring may, but rarely does, take away from the animal's ability as a breeder. The only possible disadvantage is an abnormal amount of fat and the attendant risk in getting the animal back to the best breeding condition. The animal in the sale ring is usually not so well groomed, but is in good condition and may be trained to the halter. A breeder can perhaps come nearer purchasing animals in ideal breeding condition by going to the farm and finding them under good growing conditions. In purchasing an animal, one should deal only with reputable breeders. In that case, one can usually get the worth of his money whether dealing with the owner direct or through the medium of an auctioneer or field man.

Job 4. Planning Barns, Shelters and Equipment

Conditions Usually Found.—(1) When not on pasture, beef cattle are usually kept in a small enclosed lot where they have access to a windbreak or to a covered shelter. (2) Some buildings are very elaborate and expensive, making the overhead cost too high. (3) Self-feeders, hog-tight fences, and windmills or engines to pump water into large tanks are usually found where beef cattle are kept.

Aims.—Beginners should know what is considered good equipment. They should also know how to plan, purchase, and erect or install this equipment, at a minimum of expense for the material in question.

Problems for Study and Discussion.—1. Talk with farmers, about different types of shelters, report comparative costs, and compare their locations.

2. What do the experimental results show as to the comparison between open and closed sheds for beef cattle?
3. State why it is advisable to keep the backs of the cattle dry in stormy and cold weather.
4. Describe a desirable hay and cattle barn.
5. Describe an inexpensive but good shelter which you have seen.

6. What reasons can be given as to why there are only a few beef-cattle men in the middle west who have and use silos in their operations?
7. Give comparisons as to first cost, service rendered and upkeep between two wells, one located in the lowland and the other on top of a hill, each well using a windmill or power pump to elevate the water to the top of the hill.
8. Describe the type and capacity of a self-feeder for beef cattle.
9. Compare the merits and costs of different silos: concrete, concrete block, hollow tile, wood, pit.

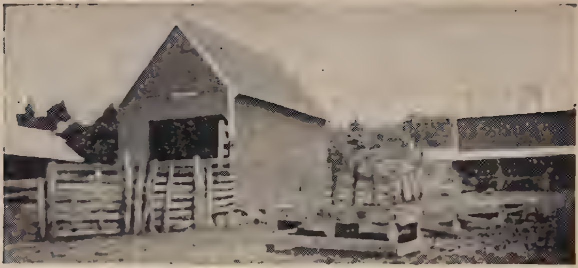
Activities.—(1) Collect pictures of cattle barns, sheds, feeding racks, scales for weighing. Mount these on cards for use in the school room and at home. (2) If possible assist in the installation of stock scales (Fig. 52), windmills and pumps. (3) Draw plans for barns, sheds, dipping vats and self-feeders. Make lists of materials for these.

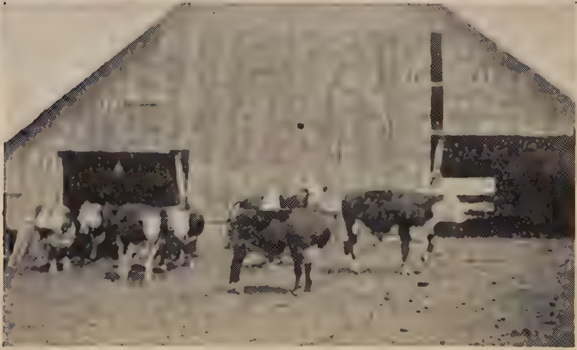
Things to Make.—Assist in building cattle sheds, hay racks, self-feeders, grain bunks, dipping vats, loading chute, watering troughs, and salt troughs.

Adequate Shelter Needed.—This problem is a necessary part in beef-cattle production. The principal thing to consider is the size, durability and suitability of shelters in relation to the size of the business. Following this, one should consider their location as to the saving of labor in caring for the animals. and their general appearance. Every one has observed farms that have too large and expensive equipment. These farms may have been developed by some wealthy person or corporation as a personal hobby rather than as an economical investment. You may have observed the other extreme, of cattle being left in a stalk field or pasture with no shelter or windbreak.

Types of Shelter.—Beef cattle have thick skins and naturally carry a good amount of flesh. For that reason cold does not harm them, provided they have shelter from rain and snow (Figs. 53 and 54). Exposure to rain, snow and severe wind uses much animal heat that should be used to produce growth or fat. The open shed is therefore desirable. Cows at calving time, if freezing weather prevails, should be kept in enclosed buildings or in box stalls. A popular type of barn for beef cattle is a rectangular-shaped building, the center of which is filled with hay. The sheds on the sides are opened at one or both ends, allowing the cattle to eat hay at the manger or lie down within the shelter. Another plan is to have open sheds for sheltering the cattle, with hay racks placed in the shelter of the shed. Temporary straw sheds, or even windbreaks of straw and corn fodder, are sometimes used in fattening cattle.

Desirable Locations.—The locations of barns and sheds are usually such as to protect the animals from the north or northwest winds of winter. Frequently a windbreak of trees is on the north side of the buildings. The buildings should also be far enough removed from the dwelling and in such a direction that the odors from the lot are carried away from rather than toward the house. A hillside location is desirable in that there is less mud in rainy weather. Farmers in general, however,





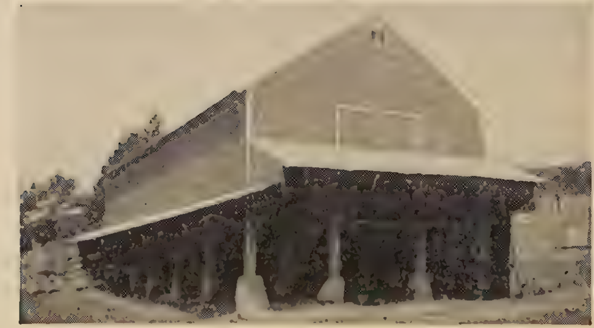


FIG. 52.—Covered scales, feeding bunk, and yard. Feeders can study methods closely when scales are used to check on the results.

FIG. 53.—Inexpensive barns are very satisfactory for the beef enterprise.

FIG. 54.—Feeding shed under barn for storage of roughage and feed. This plan is suitable for a cold climate.

believe it a good practice to have a level feed lot, and by the use of straw keep down the mud and save the manure to be applied to the farm. Feed bunks or troughs for corn and grain are usually placed in the open lot within easy access for a team and wagon.

Watering Facilities.—The water tank is usually placed in a corner or on a line fence, where animals from two or more lots can have access to it. Water is usually pumped by means of windmills, the wells ranging from 30 to 200 feet in depth. The shallow well located in the lowland, where the land is rolling, that pumps the water to the top of a hill is more economical than the deep well on the top of the hill. The cost in labor and expense in caring for a pump that elevates the water from a considerable depth by means of a straight vertical lift, is greater than the cost of laying several hundred feet of pipe to carry the water from the well in the lowland to the tank on top of the hill. Of course the conditions may not require the elevating of water to any great height.

Self-Feeders.—Many cattlemen use self-feeders for the feeding of grain, mineral mixtures, oil meal, etc. In some sections the equipment for beef-cattle production is not complete without a dipping vat. Plans and specifications for constructing these can be secured from practically any state experiment station.

Need for Silos.—Silos are considered a part of good equipment for handling beef cattle. They are a practical and economical form of investment if well constructed and of capacity suited to the size of the herd. See section on dairy cattle for this information. The use of silos results in saving much feed that might otherwise go to waste. Green and succulent feed is available during winter, or in summer when pastures are short. Crop failures may occur in some sections, and the silo is a means of carrying the surplus of feed over for use during years of feed shortage. After one has decided to build a silo the question then arises as to the type to build. There are five kinds that are common.

Concrete silos have the advantage over others in permanence and stability. The first cost is large and is greater than any of the others. They will last many years as they do not rot nor blow down, and are not attacked by vermin. If you want a permanent silo and can obtain the materials at a reasonable cost, the concrete silo is the kind to build.

Concrete-block or concrete-stave silos are the most popular type in some sections. The advantages are ease and simplicity of construction. The blocks are factory-made and are shipped ready to be put in place. Their cost is not excessive and they are reasonably permanent.

The hollow tile silo is constructed of factory-made tile set in cement or mortar. This makes an attractive. permanent and substantial silo.

If well constructed, the silo is air-tight. The outer air space provides some protection against freezing.

The wooden stave silo is economical in cost and easily constructed. These silos do not last more than 15 years and require considerable attention or they will be damaged or blown down by winds. In humid regions where the lumber can be economically obtained, they are popular. They are not adapted to the dry regions.

The pit silo has proven successful throughout the great plains area. The advantages are the low cost of construction, permanence, and ease of filling. The disadvantage is the labor required in getting the silage out at feeding time, but a type of hoist or windlass may be used to reduce labor to a minimum.

Distribution of Silos.—Figures taken from the United States census show the percentage of silage produced in each of the different sections as follows:

Section of United States	Per cent
New England	4.1
Middle Atlantic	17.3
Central	70.1
South Atlantic and Southern	5.4
Mountain	1.3
Pacific	1.8

The states producing feed crops in abundance are the ones that put up the most silage. Corn being the principal silage crop, the Corn-Belt states naturally show the greatest tonnage of silage.

Job 5. Deciding What Crops to Grow

Conditions Usually Found.—(1) Beef cattle are usually fattened where corn or grain sorghums can be successfully grown. (2) Not all feeders can grow all the grain required for fattening their cattle. (3) Many farmers have an abundance of pasture and forage crops. (4) The amount of annual rainfall and climatic conditions have an influence on the crops that can be successfully grown in a given locality.

Aims.—Young farmers should determine what crops can be successfully and economically grown for feed. They should learn how to plan good crop rotations.

Problems for Study and Discussion.—(1) What grain crops in the middle west are used as a basis for livestock feeding?

2. Name the three leading grain crops in your locality.
3. Compare grain sorghums with corn in feeding value and drouth-resistant qualities.
4. Explain the influence of altitude, rainfall, length of growing season, and temperature on the production of corn, and show why the corn belt is limited in area.
5. Name four leading perennial pasture grasses in the United States and explain why they are confined to their respective areas.
6. What leguminous crops do you find growing in your community?
7. Name the crops you find on the surrounding farms that serve as temporary pastures.

8. What crops can be used to the best advantage in filling a silo?
9. What is a suitable rotation for a farm in your locality where beef cattle are raised?
10. What uses would you make of the crops produced in the best local rotation?
11. Make a study of the feeding value of the principal grain and forage crops.
12. Prepare data of the crops grown locally, and draw conclusions as to what can and should be grown.

Activities.—(1) Collect samples of grasses and legumes suitable for pastures in your region. Preserve these for study in school and at home. (2) Tabulate on a chart the pasture and hay crops of your region, giving for each the number of pounds of seed per acre, the season for sowing. State which should be mixed together. (3) Draw a map of your farm or a neighbor's beef farm showing an ideal arrangement of fields, with the rotation of crops written on each.

Corn vs. Grain Sorghums.—In regions of the United States east of the Rocky Mountains having twenty-five or more inches of annual rainfall, corn is considered the most profitable grain crop for feed (Fig. 55). In the portions of these regions having less than twenty-five inches of annual rainfall, corn is liable to fail in some years. Experience has taught that the grain sorghums, as kafir, milo, feterita, and kaoliang, are more nearly sure of producing a crop, and as a result have largely replaced corn in the arid and semi-arid sections. Corn is conceded to be the most desirable feed for fattening beef cattle. The grain sorghums are, however, a good substitute. Ten bushels of kafir, for instance, is the equivalent in feeding value of nine bushels of corn. In seasons of prolonged drought, the sorghums have the property of suspending growth for a considerable period and resuming growth again with the occurrence of rain. This adaptability makes the crop superior to corn for dry

Fig. 55.—Corn is the chief crop to raise for feeding beef cattle.

regions. Once corn is wilted to the extent that the leaves turn white, it will not recover.

Corn at its best requires a fertile soil, rather long growing season, warm nights, high humidity and from thirty to thirty-five inches of annual rainfall. The greater part of the corn is produced at an altitude of less than one thousand feet. Corn is sometimes grown under conditions differing considerably from those just mentioned, but it cannot then be considered as a sure crop. In addition to the yield of grain, corn is an excellent crop to put in the silo or cut and shock as fodder. Like the grain sorghums, such sorgos or sweet sorghums as the amber, sumac, and orange varieties, are excellent substitutes for corn either as fodder or for putting into the silo.

Other Crops.—Alfalfa (Fig. 56) and red clover have long held their places as important legume crops for beef cattle. Sweet clover is rapidly gaining favor as a pasture and hay crop. In the plantings for substitutes or catch crops for hay, Sudan grass, millet, vetches, cowpeas, and soybeans are good. Oats as a grain crop can be very widely grown and is valuable for feeding young calves and breeding animals.

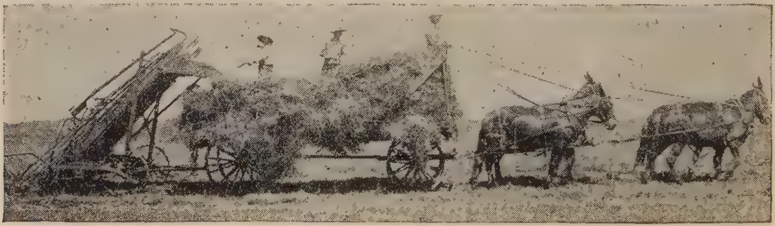


Fig. 56.—Making alfalfa hay for winter feeding.

Pasture Crops.—*Blue-grass,* where it can be grown, is the best pasture grass. The sod can be plowed and planted to grain crops and the land can again be seeded to grass, thus carrying out a definite crop rotation.

Bermuda grass occupies first place in the South as a pasture grass. This grass spreads by seed, by runners, and by underground stems. It will not endure any considerable freezing weather. It can be most easily planted by dropping portions of the roots in a furrow as the land is being plowed. Bermuda does not lend itself to a rotation as the crop is rather difficult to eradicate.

Bur clover and lespedeza, sometimes called Japan clover, are two common southern legumes that are valuable for pasture. Bur clover is a winter annual and lespedeza is a summer annual. Both reseed themselves abundantly.

Grama, the native grass of the great plains area, is a valuable pasture grass. It is nutritious, palatable, and drouth-resistant. Grama does not lend itself to a crop rotation, as it does not reseed itself after the land is once plowed. Perhaps more beef cattle are grazed on this grass than any other, making it an important factor in beef production.

Brome grass is an important meadow and pasture grass for the Northwest. It is especially adapted to the northern great-plains area. It starts growth early in the spring and grows until late in the fall. One strong characteristic is to remain succulent in hot dry weather. This grass has a tendency to become sod-bound, and as a result two or three years in meadow and two in pasture are about all it will stand. It cannot be thinned successfully. The only solution is to plow and seed to a cultivated crop.

FIG. 57.—The oats crop fits well in a good rotation and is a good feed on a beef-cattle farm.

Need of Rotation.—Successful raising of beef cattle depends upon economical production of crops. You cannot continue to grow crops economically unless a rotation is followed. Every farm can carry out some form of rotation (Fig. 57). In general a rotation should contain (a) an intertilled crop, (b) a crop for cash returns, (c) a crop for feeding to livestock, (d) a crop to increase the supply of organic matter and nitrogen in the soil. Almost all of the crop rotations presuppose a permanent pasture as a part of the plan. Annual crops and aftermath of meadows afford a considerable amount of feed at times, but such crops cannot be depended upon to supply all of the grass needed in the raising of beef cattle. The following suggested rotations take into consideration the fact that each farm will have a permanent pasture.

Types of Rotations.—A standard corn-belt rotation consists of a four-year plan as follows: (1) corn; (2) corn; (3) oats with clover, either sweet or red; (4) clover.

In some sections of the North-Atlantic states it may be desirable to use a variation such as: (1) corn; (2) oats seeded to clover and timothy; (3) clover meadow; (4) timothy meadow. Or again use: (1) corn; (2) oats; (3) rye; (4) clover.

For South-Atlantic and southern states it is desirable to follow the oats with cowpeas or soybeans, which are turned under for green manure. We may then consider: (1) cotton; (2) oats; (3) corn; (4) sudan grass.

Fig. 58.—Beardless barley may be grown to good advantage on a beef-cattle farm. The grain is fed whole or ground with other grains. The beardless straw makes fair roughage and good bedding.

Throughout the great-plains area a rotation may contain: (1) grain sorghum; (2) fallow; (3) oats or barley. In many instances cowpeas or soybeans for green manure take the place of fallow in the rotation.

In the northwestern states the rotation may contain: (1) wheat; (2) brome; (3) brome; (4) corn or grain sorghum; (5) oats or barley (Fig. 58).

Many sections can successfully grow alfalfa. Then it is advisable to leave the alfalfa for at least four years. A rotation within a rotation will often be needed. The following may be suitable for such sections: (1) alfalfa; (2) alfalfa; (3) alfalfa; (4) alfalfa; (5) corn; (6) corn; (7) oats, (8) wheat.

Number of Fields.—A rotation should contain as many crops as there are fields in the farm, e.g., (1) grain sorghum, (2) fallow, (3) oats, will require three fields. (1) corn, (2) corn, (3) oats, (4) clover, as the principal crops will require four fields. The fields should be nearly equal in size. The number of acres of small grain will probably regulate the size of the fields.

Hay and Other Roughage.—For winter feeding, good roughage should be provided. Clover, alfalfa, and other legumes are among the best roughage crops because of the saving of grain when they are used.

Mixed hay, such as clover and timothy, is a popular form of roughage in much of the corn belt. Good corn fodder and good oat straw are often used to help winter young stock but they need more grain to supplement them. Much prairie hay is used in western regions for this purpose.

Job 6. Increasing the Carrying Capacity of Permanent Pastures

Conditions Usually Found.—(1) The stand of grass in permanent pastures is somewhat lessened and even killed out by too close pasturing. (2) Other permanent pastures are damaged by excessive growth of weeds, severe weather or climatic conditions, and by fires. (3) In some permanent pastures the land is hilly. Excessive erosion occurs if an attempt is made to grow a cultivated crop before reseeding. (4) Among the perennials, only the native wild grasses will thrive in some localities.

Aims.—(1) The losses sustained from a poor pasture and the possibilities of improvement should be understood. The difficulty in making a good permanent pasture when the native grasses are killed out should be studied.

Problems for Study and Discussion.—(1) Notice the permanent pastures near your home and observe how many in the fall of the year are pastured short and close. Also observe a pasture that has not been cropped close and compare the two as to prevalence of weeds, retention of soil moisture, and the lodging of the drifting snows of winter.

2. What harmful effect may occur if the pasture is cropped too close in the early spring?
3. Explain why a well-kept pasture will show an earlier start in the spring than will one that has been pastured closely during the preceding summer.
4. Mention some good results that have been obtained where blue-grass pastures have been disked, manured and reseeded.
5. In what ways can a stand of Bermuda grass be increased?
6. Give some of the methods that are used in improving the pastures and ranges where grama, the native western grass, is grown.
7. Describe a way to check erosion, the cutting of deep ditches, in a permanent pasture.
8. Under what conditions is liming advisable?
9. Commercial fertilizers may be profitably used when and where? What kinds?
10. Discuss the benefits of mowing weeds in permanent pastures. When done?
11. What are the advantages and disadvantages of shade in pastures?
12. What should be the distance between watering places in large pastures?

Activities.—(1) Make a collection of pasture and hay-field weeds and preserve these for study at home and at school. These may be mounted on cards and properly named. (2) On a chart make a list of the common weeds and opposite each give the methods of spreading and methods of control. (3) Make a chart giving a list of methods of maintaining or improving pastures with probable cost for each opposite it.

Keeping down Weeds.—Pasture improvement is a problem for every farmer. Grass is the cheapest feed for beef cattle. Any means of increasing the yield of pasture grasses will enable the farmer to produce beef more economically. Weeds, too close pasturing, and fires, are detrimental factors that can be corrected. Grass, if given a reasonable amount of moisture and an opportunity to grow, will successfully overcome the growth of weeds. One Iowa farmer pointed with pride to a large acreage of blue-grass pasture that has been in grass continuously since the year 1887. When asked how he cared for it, he replied that he cut the weeds once in a while with the mower.

Mowing weeds in a permanent pasture is advisable. August is the best month to mow weeds. They are ready to form seed and are not likely to produce a second growth if cut at this time. The sickle bar should be raised as high as the shoes will permit in order to avoid cutting the grass too low.

Sheep turned on a pasture for a short period of time may assist greatly in keeping down the weeds.

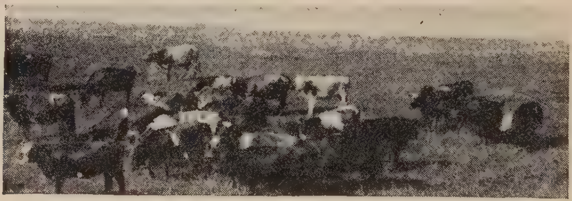


Fig. 59.—Beef cattle on summer pasture should be in good condition for the feeding lot in fall.

Light vs. Heavy Pasturing.—A reasonable growth of grass left on the ground will assist in holding moisture. The decay will provide plant food for the roots and it will serve as a mulch. This will cause the grass to start earlier in the spring. In the humid regions the carrying capacity of a pasture will be much increased if the grass is allowed to attain a growth of three or four inches before cattle are turned on it in the spring (Fig. 59).

Improving Blue-Grass Pastures.—The Iowa Station has done some work in pasture improvement. The experiments include forty-seven plots variously treated to disking, reseeding, manuring, and applying commercial fertilizers. The results show profitable returns from the use of barnyard manure and from the use of a number of commercial fertilizers. The authorities, however, strongly recommend disking, reseeding with legumes and the application of 150 pounds of superphosphate per acre to any blue-grass pasture. (Fig. 60).

Improving Grama Grass Pastures.—Throughout the entire great-plains area (Fig. 61) from north and west to the southwest, the possibility of pasture rotation is not considered. Reseeding is not practical because the dry years that are sure to come will kill out any grass except the native grama. The possible solution narrows down to the improvement of the existing pasture areas. U. S. Farmers' Bulletin 1428 mentions three ways of range improvement.

1. Limit number of cattle to the range capacity of poor years. There is a tendency in the years of increased rainfall to keep enough cattle to use all of the grass, hoping that the following year will be similar. This plan frequently results in severe losses of cattle from starvation during the dry years.

Fig. 60.—Shorthorn cows and calves on blue-grass pasture.

2. Reserve a part of the range for any critical period. It has been demonstrated that it is profitable for cattlemen to set aside a portion of the range to be used when the main grass supply is exhausted. This means that in certain years there is a considerable amount of unused grass. The expense of keeping the extra range is less than the loss that may occur during a dry season if the owner does not have enough grass to maintain his herds.

Fig. 61.—Native grass pastures fenced separately, Texas Panhandle.

3. Develop adequate watering facilities. If the watering places are too far removed from each other, there is a tendency for the cattle to

pasture too closely the areas near wells. In times of drouth the weakened cattle cannot travel the long distance between grass and water and loss will result. They should not be expected to travel more than two and one half miles to water.

Erosion.—In any pasture where the land is rolling or hilly, erosion is likely to occur at times. A heavy downpour of rain causes a considerable run-off of water. This often washes deep ditches.

To control these gullies, the Iowa extension service uses two types of dams. The first dam consists of three posts and a short piece of woven wire fence. The posts are driven, one in the center of the ditch, and one on either side with the tops down stream slanting at an angle of about forty degrees (Fig. 62). The top of the center post is lower than the tops of the posts on the bank of the ditch. The woven wire is stapled to the three posts on the upstream side. The second type of dam consists of posts placed as those of the first plan, with a few pieces of brush placed with the butts at the bottom of the ditch and the tops leaning against the three posts and pointing down stream. A quantity of straw is then thrown on the brush.

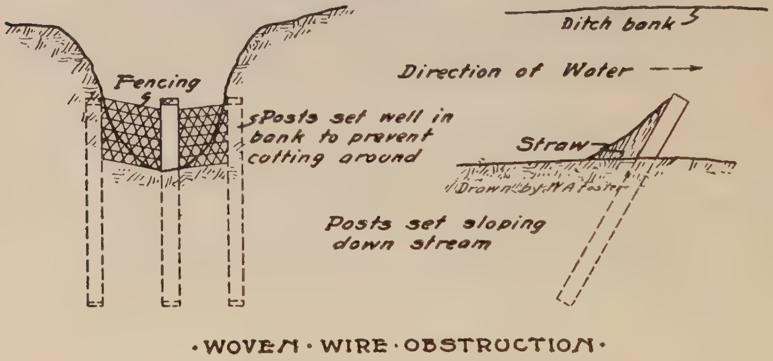

Fencing
Posts set well in bank to prevent cutting around
Ditch bank
Direction of Water →
Straw
Drawn by H A Foster
Posts set sloping down stream
WOVEN · WIRE · OBSTRUCTION ·

FIG. 62.—Gullies in pastures should be checked before they become large. Obstructions of woven wire are easily, quickly and cheaply made. They cannot be considered permanent, but if watched they are the means of forming a good fill. (Iowa Experiment Station.)

Either type of obstruction slows the speed of the water, allowing it to deposit the sediment it is carrying and producing a small fill. These dams, being lower in the center than at either bank or side of the ditch, cause the water to continue flowing in the same stream and not to cut any new channel as is usually the case where a large cement dam is constructed. Other dams can be placed at desired intervals down the stream. The material is inexpensive and it will result in a gradual filling of even a large ditch.

Shade.—Cattle enjoy being in the shade during the heat of the day (Fig. 63). Contented cattle in a wooded pasture make a splendid setting for a picture; but, economically considered, the trees use so much soil moisture that they interfere with the growth of the grass, except in rainy seasons. Open prairie land is the best for pasture. A shade of a few trees near the water or elsewhere may pay well. A shed of cut tree limbs may serve the purpose.

Fig. 63.—Permanent pastures should be provided with ample shade.

Job 7. Buying Concentrates and Supplementary Feeds

Conditions Usually Found.—(1) Late springs and severe weather conditions may make it necessary for cattlemen to buy additional feeds. (2) Many cattlemen cannot buy individually in sufficient quantities to make the purchase of concentrates and supplementary feeds profitable. (3) Many persons realize only in a general way the value of a balanced ration for beef cattle. (4) Some farmers believe it is important to consider the chemical analysis when buying any concentrate or supplementary feed. (5) Other feeders do not study experiment-station results closely enough to know just when the purchase of high-priced concentrates or supplementary feeds will result in increased economic gains with their beef cattle.

Aims.—(1) Students and farmers should know the properties of feeds that they may purchase them economically and feed them effectively to beef cattle. (2) They should learn how best to supplement the feeds produced at home. (3) They should know the advantages of coöperative buying.

Problems for Study and Discussion.—(1) What is meant by concentrates and supplementary feeds?

2. Which feeds will produce fat on the animal?
3. Name the class to which they belong.
4. Name the chief feeds that are valuable in putting muscle and lean meat on the beef animal, and state the class to which they belong.
5. Tell what is meant by a balanced ration. Demonstrate the process of calculating a balanced ration.

6. What feeds in addition to those grown in your locality are needed to produce a balanced ration?
7. Explain the meaning of the terms "wide rations" and "narrow rations." Calculate balanced rations made up of the feeds on home farms. Compare the feeding value and cost of home-mixed feeds vs. commercial-mixed feeds.
8. Why do cattlemen, in buying commercial feeds, study these feeds in relation to crude fiber, digestibility, and palatability?
9. Under what conditions is it wise to buy medicated salt for cattle?
10. What are condimental stock feeds?
11. Make a list of reasons for buying feeds coöperatively.

Activities.—(1) Make a chart of home-grown feeds rich in protein and purchased feeds rich in protein. (2) Make another chart of feeds rich in carbohydrates. (3) Collect samples of as many feeds as possible. Place these in bottles and label them for reference at school or at home. (4) Practise mixing rations from home feeds or supplemented with some purchased feeds.

No farmer should buy additional feeds unless the transaction will appear profitable from the viewpoint of additional gains in the animal or improved health conditions that will affect the offspring. An attempt should be made to grow on the farm all the roughage and as much of the grain as is possible. Some farmers grow as much as 60 per cent of their grain and find it profitable to purchase the remaining amounts needed. Each farmer will at some time want to buy supplementary feeds, protein supplements, or condimental feeds.

Protein concentrates are the ones usually purchased. Where such feed is needed, the job may be to decide between wheat bran, cottonseed meal, linseed meal, or oats. Each ration should contain a certain amount of each of the three classes of feeds—protein, carbohydrates and fats—as well as mineral content and bulk. The feeds on hand will to a large extent govern the purchase of supplementary feeds. Cottonseed and linseed meals are comparable in feeding value. They are both superior to wheat bran or oats as protein supplements for feeder steers. Oats are valuable for calves and breeding animals. Cottonseed and linseed meals can be fed in quantities of 2.5 pounds per head daily over a period of several weeks. Such carbonaceous feeds as corn fodder, corn silage, timothy, brome, and prairie hay, need such supplements. Alfalfa hay, being rich in protein content, will not require a supplement. Animals given mixed clover and timothy hay should have from one to two pounds per head per day of a protein supplement, as cottonseed meal.

Condimental Feeds.—These feeds are sold under such trade names as "stock food," "condition powder," "mineral mixtures," or vitamin preparations. Such feeds are sold upon the basis of their ability to stimulate the appetites of the animals, and contain only a minimum of the desired ingredients. They are usually dependent upon good care and management for accomplishing the best results. Extra care in feeding of animals will in itself do much toward improving their condition.

Common salt, copperas, fenugreek, gentian, pepper, Epsom salts, etc., constitute the principal ingredients of condimental feeds. These are often mixed with linseed meal. The reason for the sale of these feeds is that many farmers do not care to make a study of the ingredients of feeds and perform the necessary work of home mixing. If they do not buy, they will do without, and as a result will not obtain the desired benefits. The possession of a feed grinder and a floor space large enough for the mixing to be done, will aid materially in the home-mixing and preparation of these feeds. This can well be handled as a rainy-day job.

Job 8. Attending to Registration of Animals

Conditions Usually Found.—(1) Pure-bred cattle of recognized ancestry are usually registered in a herd book kept by the secretary of the breed association. (2) Some farmers raise cattle eligible to registry but fail to register them.

Aims.—(1) Beginners and farmers should be familiar with the details necessary in making applications for registration of pure-bred animals. (2) They should know the benefits of this and the responsibility involved.

Problems for Study and Discussion.—(1) Study the rules and regulations of the different registry associations to determine the details connected with filing applications of registry.

2. What are the benefits of keeping all the good pure-breds registered?
3. How are animals marked permanently?
4. What responsibility is placed on the breeder by the association?
5. What are the best ages for registering cattle? Why?
6. How are transfers recorded? Why?
7. Give reasons for keeping dates of breeding, and calving.
8. Practise giving names to young animals which will indicate ancestry.
9. At what age would you register calves?

Activities.—(1) Obtain registration blanks from the leading breeding association and fill these for the registration of animals owned locally. (2) Fill forms for dams, sires, and calves. (3) Obtain transfer blanks and fill these. (4) Practise marking animals for registering.

Attending to Registration of Animals.—There are seven American record associations for beef cattle. In addition, certain states have their own state associations.

Rules.—Each association has rules governing registration. These rules can be obtained by applying to the secretary of the association; only general requirements are given here.

Become a member of an association; advertising value results. Extra registry and transfer fee are charged non-members.

Name and address of owner of sire.
Name of owner of dam.
Name and herd-book number of sire.
Name and herd-book number of dam.
Sex of animal to be registered.
Date of birth.

Signature of owner of dam at date calf dropped.
Statement of transfer of ownership.
The dam must be at least 27 months old.
No calf is eligible until 6 months old.
Mark every animal permanently.
Halter breed whenever possible; date of pasture-breeding uncertain.
Cancel registration of animals that die.
Cancel registration of animals sold for beef.
Keep personal written records in ink.
Select name carefully.
Fill all blanks of application.
Check records before sending application.

Each student should write to the secretary of his favorite breed for a few copies of blank application and transfer forms. Fill these and discuss the same with the class. See names in Appendix.

Value of Registration.—All pure-bred cattle not definitely intended for slaughter should be registered. Registration adds to the selling value and makes it possible for the immediate offspring to be registered. If complete records can accompany the animals at time of sale the buyer need not worry about inaccuracies and delays that may happen if registration is done by mail at a later date. Breeders are responsible for accuracy of records. The association may at any time require the breeder to support the application for registry by private records. If records are not in writing, doubt may be cast upon their accuracy and registration refused. Accurate written records protect the breeder's reputation and satisfy the association.

Age to Register.—Animals cannot be registered until after they are six months of age. Prior to six months of age the application should be filed and the fee paid. Anyone purchasing such calves may be assured of receiving certificate of registration when the animals reach six months of age.

Transfers.—The recognized owner of any registered animal is the owner as recorded in the registry association. If the animal has been transferred after date of entry, the legal owner is the last owner as recorded on the books of the association. In case of death of recognized owner, other persons properly authorized may, upon identifying the animal, transfer the same to another party. Special precautions are taken against duplicate, or unlawful claims of ownership.

Markings.—The tattoo is probably the best permanent marking to be used. Ear tags, hoof brands, and neck chains are good, but are temporary in nature and need to be examined and renewed. Calves should be marked long before weaning in order to prevent mistaken identity. The owner should not depend upon memory. In case of death of owner, only written records and permanent markings are desirable. Pure-breds without identification marks may be no more valuable than good grades.

Job 9. Caring for and Managing the Herd

Conditions Usually Found.—(1) Breeders usually decide upon a single objective, as raising either "baby beef," "beef," or "dual-purpose" cattle. (2) Beef calves are usually dropped during April and May. (3) Supplemental feeding of calves during August and September may be practised, preparatory to weaning in October. (4) Owners of large herds need to consider number of matings for bull. (5) "The eye of the master fattens his cattle."

Aims.—Breeders should know that managerial problems are of equal importance with operative problems. They should know the details of managing a herd.

Problems for Study and Discussion.—(1) What factors make dual-purpose cattle and baby-beef production intensive types of farming?

2. How may beef production be classed as extensive farming?
3. Which of these three forms of beef-cattle farming are found in your region? Compare them in importance.
4. What is the value of a gestation table and how is it used?
5. Describe cases of good and bad management in feeding beef cattle.
6. Show the bad effects of overfeeding.
7. How would you manage to bring steers to "full feed?"
8. Compare daily feeding with the self-feeder system.
9. In what sense does "the eye of the master fatten his cattle?"
10. In what sense is a good manager a "feed detective?"

Activities.—(1) If possible, run a trial in fattening cattle with and without self-feeders. (2) Make a table for recording breeding dates on a local farm and fill this or have it filled by a breeder. Calculate from the table the probable time of birth of calves.

Need for Management.—Managerial problems are so closely related to operative problems that their separation is more often imaginary than otherwise. Withal, there are certain problems of a managerial nature that must be met in handling beef cattle. Location, size and value of farm, personal likes and dislikes all enter into the problem of establishing an objective in growing beef, baby-beef or dual-purpose cattle.

Baby Beef.—If the plan is to sell the animals as baby beef, cattle of high quality must be kept (Fig. 64). There will be a smaller number of cattle to keep on a given farm, thus requiring less pasture land than is the case with beef cattle. This means smaller farms. On high-priced land, any part of which can be used to produce grain crops, the plan of growing and fattening baby beeves is practical.

Beef Cattle.—Beef cattle to be marketed as two-year-olds can be kept most satisfactorily on large farms, having large pasture areas (Fig. 65). One would expect to keep cows, calves, yearlings and two-year-olds on the farm the greater part of the time. This type of beef-cattle raising is adapted to cheaper lands that will grow abundance of grass and forage crops. Many such farms are located long distances from the railway lines.

Dual Purpose.—The raising of dual-purpose cattle is adapted to small farms. In some instances each cow is milked. In other instances the practice of placing two calves with one mother is followed, and only a part of the cows are milked. A bunch of steers is fattened each year. The dual-purpose herd can use to advantage large quantities of both grain and forage crops. To facilitate marketing the milk products, these farms should be located reasonably near a railway shipping point.

Fig. 64.—Baby beeves that topped Chicago market.

Use of Gestation Table.—The bull should not be allowed to run with the cows unless a very close watch can be kept during the breeding season. Pasture breeding involves an uncertainty as to date of breeding and date of birth. This uncertainty can be corrected by keeping the bull to himself and turning a cow into the paddock with the bull when time for breeding arrives. An accurate record of the breeding date should be kept. The gestation period for the cow is about 283 days.

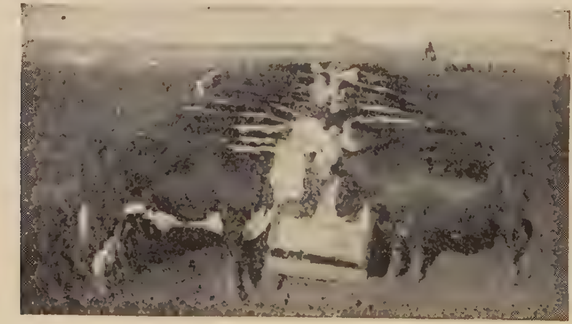


Fig. 65.—A grain feeding bunk in pasture for summer feeding.

The following condensed table enables one to calculate closely as to date of birth.

Gestation Table

DATE OF SERVICE	DATE DUE	DATE OF SERVICE	DATE DUE
Jan. 1	Oct. 10	July 10	Apr. 18
11	20	20	28
21	30	30	May 8
31	Nov. 9	Aug. 9	18
Feb. 10	19	19	28
20	29	29	June 7
Mar. 2	Dec. 9	Sept. 8	17
12	19	18	27
22	29	28	July 7
Apr. 1	Jan. 8	Oct. 8	17
11	18	18	27
21	28	28	Aug. 6
May 1	Feb. 7	Nov. 7	16
11	17	17	26
21	27	27	Sept. 5
31	Mar. 9	Dec. 7	15
June 10	19	17	25
20	29	27	Oct. 5
30	Apr. 8		

Care of the Calves.—Beef calves are usually allowed to run with their dams during the first six months of their lives. If a cow is on good pasture and gives a good supply of milk, the calf continues to gain rapidly. It is well to teach the calf to eat grain before weaning time as it will lose weight if forced to live on grass alone. If the calf is allowed the run of a separate pen, it will learn quite early to eat ground corn and oats. A little later cracked grains can be substituted and soon the whole shelled grain can be fed.

Counsel for the Feed Lot.—Successful management in the feed lot involves a degree of judgment that is difficult to describe. The ability to feed an animal so it gains steadily for a period of five months is a thing worth striving to attain. Scours caused by overfeeding, or an improper handling of feeds, may cause the steer to lose as much in a day as was gained the week previous. Feeding only what the steers will eat and removing all of the partially eaten ears before another feed is added will aid in keeping up the appetite. The droppings should be loose yet have enough consistency to form in a pile. The odor should not be sour.

Quiet and order should prevail in the feed lot. Steers respond to good treatment in not being afraid of the operator and in arising quietly when approached. Avoid frightening the steers. Caution strangers about being quiet. The way in which the steer approaches the trough at feeding time is some indication of his appetite and aids the operator in judging the amount of feed to supply.

Job 10. Detecting and Preventing Disease

Conditions Usually Found.—(1) Serious losses often occur through communicable diseases. (2) Many cattlemen do not vaccinate to prevent, or test to detect, the presence of disease in the herd. (3) Some persons oppose the county eradication plan for certain diseases.

Aims.—(1) Young farmers should know the value of disease prevention. (2) They should develop judgments and skills needed in raising disease-free animals.

Problems for Study and Discussion.—(1) What steps should be taken in order to counteract an outbreak of infectious abortion in the herd?

2. What preventive measures should be taken with a healthy herd?
3. At what age should calves be vaccinated against blackleg?
4. Describe the way the vaccine is administered.
5. What is foot-and-mouth disease?
6. Describe the plan usually followed in eradicating foot-and-mouth disease.
7. Show the manner in which Texas fever can be prevented.
8. Explain the plan for enlarging the "tick-free" area.
9. To what extent have beef-cattle breeders attempted to keep down the spread of tuberculosis in their herds?
10. Describe the county eradication plan, and tell why some beef-cattle breeders oppose its adoption.
11. What are the usual symptoms of milk fever?
12. Which cows does it attack?
13. Describe the most practical method of checking the course of a milk-fever attack.
14. Give the life history of warbles and state the damage that occurs from their presence.
15. What is a practical method of getting rid of lice?
16. When is dehorning advisable? Describe two methods.
17. Describe the process, and state the desirable age for castration of beef calves.
18. How do you drench an animal?

Activities.—(1) Assist in washing a bull after or before service. (2) Practise inoculating calves against blackleg. (3) Assist in dipping cattle for ticks or lice. (4) Assist in testing cattle for tuberculosis. (5) Find warbles in cattle and try removing them. (6) Practise treating calves to prevent horns. (7) Aid in dehorning cattle. (8) Castration should be practised. (9) Administering medicine by drenching should be practised when needed.

Contagious abortion is more common among cows than with any other class of animal. It is a contagious germ disease, the germ being carried from an infected animal to a healthy animal, through the process of breeding.

Abortion is the expelling of the developing fœtus. Abortion may occur so early in the period of gestation that the animal will show but little outward signs. The recurrence of heat may be the first recognized symptom. Abortion may also occur so late that the calf will be born alive. Such calves rarely live any length of time. In cases of abortion isolate the cow and then wait 24 hours. If by that time the fetal membranes have not been discharged, they should be removed. Their retention will cause a discharge and disagreeable odor from the vulva and produce fever and infection in the animal.

The aborting cow, unless a very valuable animal, should be sold for beef. Any infected animal should be isolated immediately from the remaining animals of the herd. Preventive measures should be taken with the bull. If possible, he should not be allowed to serve an infected cow. If service is allowed, the sheath should be irrigated before and after service. Newly-purchased breeding cows, or cows bred outside the herd should be isolated until the time for the next period of heat shall have passed to avoid a possible introduction of the disease. Such sanitary measures should be taken as to burn the discharged fetal membranes, clean out the manure and bedding and disinfect the building where the infected animal was confined. (See Job 9, dairy enterprise.)

Blackleg is a highly infectious disease. The germ lives in the soil. It has great vitality. The disease attacks animals from six months to two years of age that are in good condition. The general symptoms are lameness, dullness, loss of appetite, tumors or swellings in the regions of the shoulders and thighs, and finally prostration. Death usually occurs within a few hours. Humans run the risk of contracting the disease if they skin the animal that has died of blackleg. They should be sure there are no open sores or cracks in the skin of their hands. It is best to burn the carcass where the animal has died, if this can be done. Dragging the carcass over the ground may scatter the germs. The disease usually occurs in late winter or in late fall.

At least one vaccination should be given each calf for the first year of its life. Two for the second year will be well. After two years of age, the animals are not likely to become infected. The vaccine comes in the form of a pill that is injected beneath the skin of the shoulder by means of a hypodermic syringe, after being dissolved. The animal should be roped. It may either be thrown or tied against the side of the stall in a standing position.

Foot-and-mouth disease is one that attacks cattle. It is not always fatal and may attack an animal more than once. The specific organism causing the disease is not well known, but it is known that an outbreak cannot occur unless the germ is carried from some infected animal.

The symptoms of the disease are dullness, high fever, swellings about the size of a pea upon the lips, tongue, about the hair of the hoof, and between the toes. Later a discharge occurs from these swellings. Infection can be accomplished by rubbing some of the discharge from the mouth of the infected animal upon the inside of the lips of a healthy animal. Animals may also become infected through any secretion or excretion of the infected animal, as milk or manure, or by touching the fences, watering troughs, etc., that the infected animal has touched.

Infection may occur through so many sources that inoculation to prevent the disease is not advised. In European countries some inoculation is practised with healthy animals in order to hasten the progress of the disease. This may cause the attack to be less severe.

Rubber boots and rubber clothing are generally worn by men around cattle infected with this disease, because rubber can be washed. The person not taking this precaution is expected to fumigate the outer clothing and disinfect the soles of the shoes upon leaving an infected area.

Texas Fever.—Tick fever or Texas fever is common in the southern part of the United States and in warm climates of foreign countries. The progress of the disease is peculiar in that one animal does not give it directly to another. The carrier of the disease is a tick, the adult of which is about three eights of an inch in length. This tick lives on the grass the greater part of its life. As the animal grazes or lies on the grass, the tick attaches itself to the body where it sucks blood and grows to adult size. While sucking the blood of the animal, the tick transmits the germ of the disease. Animals raised in these localities or taken in as calves develop an immunity to the disease. The presence of a large number of ticks, however, on the body of an animal hinders its growth to a considerable degree. After the tick has sucked its fill of blood it drops off on the ground. Its function is to lay eggs on the grass, after which it dies. Other ticks hatch from the eggs and live upon the grass for a period of time until they can attach themselves to some animal feeding in the grass.

If all animals—horses, cattle, sheep, etc.—are kept out of a pasture for a period of nine months, the young ticks will die, because each tick must obtain the blood from some animal to complete its life cycle. This is the method used in increasing the tick-free area. Dipping vats are used over county-wide areas to destroy and eradicate all ticks.

Cattlemen living in the south usually buy their females as calves, thus running but little risk in getting them acclimated to tick fever conditions. Mature bulls when purchased are usually turned over to a veterinarian for inoculation for tick fever. Even then death sometimes results. Animals once having Texas fever and recovering are immune against further attacks.

Tuberculosis.—Tuberculosis in beef cattle is not nearly so common as in dairy cattle. This is due largely to the fact that the animals are as a rule younger when slaughtered and are not usually kept in enclosed buildings. Perhaps not more than 2 per cent of the beef cattle slaughtered show tuberculosis infection. The medical world is generally of the opinion that bovine tuberculosis is a cause of human tuberculosis. The disease does cause a loss of a considerable number of beef cattle. Its effect on the prevalence of the disease among dairy cattle is enough to justify the effort of eradication.

An animal may have tuberculosis and show little outward signs of its presence. The only sure way to detect the disease is by use of the tuberculin test. Reference should be made to the section on dairy cattle for a description of the tuberculin test and the workings of the county eradication plan. The only way a herd can get tuberculosis is through the addition of an animal carrying this infection. It does not originate spontaneously, but comes from a specific germ or bacillus that is transmitted from animal to animal. Sanitary surroundings, well ventilated buildings, and the prompt disposal of reacting animals are the ways of keeping down the spread of tuberculosis. If a valuable cow shows infection she may be kept until after the calf is born. The calf should not be allowed to suck the cow. If then raised on clean milk and kept in suitable surroundings, there is little probability that it will take tuberculosis.

Warbles are small grubs or worms that develop from eggs laid by the heel fly, sometimes called the warble fly. This fly lays her eggs on the legs of cattle in the fall of the year. The animal in licking itself will carry these through the mouth into the digestive tract. These eggs hatch and the larvæ or worms find their way to the region of the back and loin. During the winter months, small lumps will appear on the backs of the animals. If left alone they will remain there until the warm days of spring. They may, however, be forced out of the skin by pressing each of the lumps with the fingers.

As the warbles are emerging, their presence is indicated by nervousness on the part of the animal. They throw their tails up over their backs and run rapidly for a short distance. Washing the legs during summer and late fall with five per cent solution of carbolized sweet oil will destroy the eggs. Crude petroleum may be used. Dipping will be necessary for anything except gentle cows and small calves. Two or three years of treatment should practically exterminate the fly from the herd and farm.

Lice cause cattle to have a rough staring coat, which is accompanied by the animal licking and rubbing the skin. The licked part is matted and curled. Lice are found most easily on the back and rump. Lice may be killed by washing the animal with a one or two per cent creosote solution. During winter weather care should be taken that the animal does not take cold. Choose a day when the sun is shining and blanket the animal as soon as washing is completed. Barns and sheds should be cleaned and disinfected. All manure should be disposed of and the walls and floors sprayed with creosote solution.

Dehorning.—Cattle intended for slaughter purposes are usually dehorned. This process prevents injury to other animals and makes the housing and feeding problem easier. Week-old calves may be dehorned by rubbing a stick of caustic potash on the horn or button as it first appears. Spread vaseline on the surrounding hair and skin for protection. Moisten the horn and rub two or three times with potash. Keep the calves out of the rain for two or three days to facilitate the action of the potash.

Mature cattle are dehorned by placing them in a special chute, the head being held in a stanchion. A meat saw is usually used, the cutting being done one-fourth to one-half inch below the hair line. The dehorning is quickly done and the animal rarely suffers appreciably unless a hemorrhage occurs or it accidentally receives a jar or jolt on the head. (See Job 5, dairy enterprise.)

Castrating.—All male calves not intended for breeding purposes should be castrated within the first four months of age. Young calves are usually tied by the head and cast on their side by placing a rope around the hind legs and pulling to the rear until the calf falls on its side. Castration may however be done in a standing position, if the animal can be securely tied against a wall or board fence. Wash the scrotum with a disinfectant. With the testicles pressed tightly against the scrotal wall, the incision should be vertical and parallel with the line between the testicles and extending well down, to aid in bleeding and drainage. If sanitary measures are followed, no further treatment need be given. The spring and fall months are desirable times to castrate. This avoids flies and extremes of heat or cold.

Drenching.—It is sometimes necessary to drench cattle. The medicine should be mixed with just enough water to make a dose of desirable size. A heavy glass bottle with a long neck is generally used. The animal should be tied. (A horse stall makes a desirable place.) Elevate the head *slightly* by tying a small rope in the mouth and running the rope up across an overhead beam. The operator should stand in the manger and administer the dose in the amounts the animal will swallow readily.

Other Troubles.—In the dairy enterprise, the student of beef cattle will find valuable discussion of scours in calves, pneumonia, bloat, milk fever, cow-pox, hoof-rot, inflamation of the udder, ringworm, garget, chapped teats, warts, and lumpy jaw. Care of feet and methods of throwing cows are also discussed.

Job 11. Producing Baby Beef

Conditions Usually Found.—(1) In general, baby beeves are produced from pure-bred strains of beef cattle. (2) Care is taken to see that these calves are constantly gaining in weight. (3) Baby beeves are usually sold at from sixteen to twenty months of age.

Aims.—The care and skill necessary in handling and feeding calves that are to be sold on the market as baby beef should be known.

Problems for Study and Discussion.—(1) What feeds should the calf be eating at five months of age?

2. How should the calf be handled up to the time of going into winter quarters?
3. What winter rations should be given?
4. Compare dry-lot and grass feeding as means of fattening baby beef.
5. At what age are calves not intended for baby beeves weaned?
6. Debate spring vs. fall calving for baby beeves in your region.
7. Compare good pastures with corn fields for the calves about weaning time.

Activities.—(1) Run a trial in comparing two farms for the purpose of contrasting the feeding of baby beeves with and without pasture. (2) In like manner compare by trial the late and early weaning of calves in the production of baby beeves.

FIG. 66.—Baby-beef projects pursued by vocational students. Calf weighed 960 pounds at one year.

FIG. 67.—Hereford baby beef and student owner (Rudd, Ia.)

Field Trips.—Take trips to farms of the community where baby beeves are produced and study details of methods followed. Debate, going: "Baby-beef production vs. other forms of the beef enterprise." Returning, discuss methods and practices found.

A Baby Beef Project.—The task of producing baby beef is one of deep interest and practical value to the student of vocational agriculture. Many times a baby beef is chosen by the pupil as an individual project. The skill and knowledge gained in selecting, feeding and handling an animal of this class is of inestimable value as a student enters into farming for himself. (Figs. 66, 67, 68).

Type.—If the calf is to be fed and sold as a baby beef, the same principles of selection will apply whether it is raised on the home farm or purchased from another breeder. At least the sire should be a pure-bred animal. He should show a blocky, early-maturing type, with plenty of quality. If the dam is not a pure-bred animal, she should show at least three generations of pure-bred crosses. The calf should show signs of early maturity, quality, and smoothness. Size is desirable so long as it does not indicate late maturity. If a number of calves are to be fed and sold together, it is highly desirable that they show uniformity. Where calves are raised, this uniformity can be accomplished by the use of a prepotent sire on good cows, and by having the cows all calve within a period of three weeks. Shorthorns, Herefords and Aberdeen Angus are equally good breeds from which to select baby beeves.

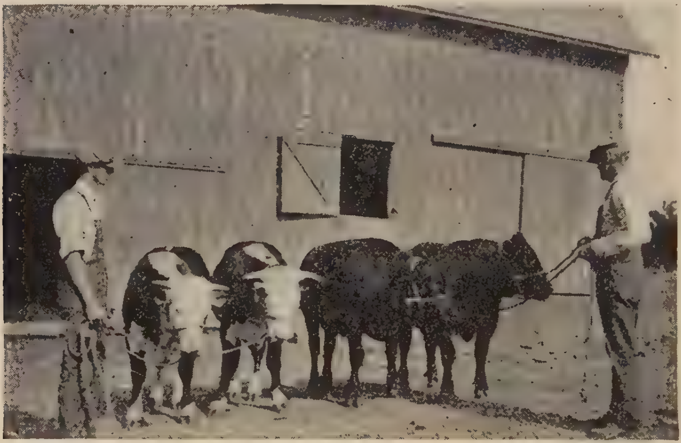


Fig. 68.—Student and father with baby beeves. Left, Hereford; right Angus.

Management and Feeding.—It is not the purpose here to review all of the literature on the subject of baby beef. One successful illustration should suffice.

M. R. Calley of Guthrie county, Iowa, shipped a load of yearlings, steers and heifers mixed, that were sold on the Chicago market July 19, 1926, at $10.50, the top of the market for that day. Their average weight was 835 pounds. Mr. Calley made a statement regarding the thirteen heifers and eleven steers:

"All were calved between the dates of April 1 and 15, 1925. These calves ran with their mothers on good blue-grass pasture, with a substitution late in the summer of the second-growth grass of timothy and clover meadows, until November 25. They were then turned into the stalk field after the corn was husked and remained until the snow fell, about December 20. They were then weaned. I started them on oats, clover hay, and cane fodder. In about three weeks I began to add crushed corn and cob. About the middle of March a little linseed-oil meal was added to the ration. From about the first of May I fed three parts of crushed corn and cob to one part of oats and two pounds of linseed meal per day per head, with all of the clover hay they would eat. They had before them at all times a mixture of salt, lime, sulphur, copperas, Glauber salts, and saltpetre."

Baby beeves are usually sold at from 16 to 20 months of age. In general, the pupil will select an animal calved in the spring. The advantages are that in showing at the county and state fairs, the calf will have considerable size and still be within the class of yearlings. Some breeders prefer their calves to be born in the fall; the majority, however, prefer the spring months. The advantages and disadvantages of each should be learned from farmers and may be discussed.

Weaning time is usually considered as six months of age. If cows are not milked, the calves may be allowed to run with the mothers until all are brought in from the summer pastures. It is safe to let baby beeves reach the age of eight months before being weaned. They must not be delayed in their rapid development and must not lose any of their baby flesh.

Growth in Popularity.—The growth in number of baby-beef projects for vocational agricultural students and for club members has done much to popularize the production of baby beeves. The fathers have accepted the plan as profitable.

Job 12. Showing and Selling Breeding Stock

Conditions Usually Found.—(1) Many breeders of pure-bred beef cattle show their herds at county, state and national fairs, and hold annual or semi-annual public sales. (2) Many cattlemen are skilful in training and preparing cattle for the show ring. (3) Progressive cattlemen often advertise in farm papers and magazines during a part of the year. (4) Many use signs and posters in the vicinity of the home farm as important factors in selling beef cattle.

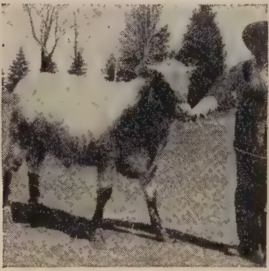
Aims.—(1) Methods of advertising, showing, and selling of beef cattle should be known. (2) The methods used by the most successful cattlemen should be learned.

Problems for Study and Discussion.—(1) At how many state fairs each year do the progressive cattle breeders show their herds or individuals?

2. Name four large regional and national fat-stock shows at which many breeders exhibit their stock.
3. What advertising value comes from exhibiting at these large shows?
4. Compare the relative merits of ancestry, individuality, and performance in advertising a herd of beef cattle.

5. Describe the services rendered by the field men sent out by the livestock newspapers and the breed associations.
6. What steps should be taken in planning a sale of pure-bred beef cattle?
7. Mention some methods of permanent advertising as contrasted with periodical advertising.
8. What care and training should breeding animals receive in preparation for the sale ring?

Activities.—(1) Prepare calves, baby beeves, and other beef animals for fairs or for sale. (2) Mark cattle intended for show or for sale. (3) Practise handling cartle for these purposes (Figs. 69, 70). (4) Obtain fair premium lists and select animals to feed for show in each of the classes given. (5) Collect a number of sale catalogs of beef breeds and decide which you would most closely follow in making a sale catalog for your own or a neighbor's herd. (6) If possible make up a catalog of a local herd.



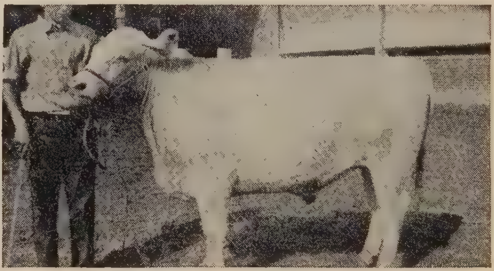


Fig. 69.—Training baby beef animal to lead and handle well before the fair.

Fig. 70.—Practice in posing animals for show is necessary for success at the fair. This student should cause the animal to step the rear feet back a little.

Field Trips.—The class should attend a public sale of pure-bred beef cattle, and study how animals are prepared, marked, handled, and sold. Also attend fairs where beef animals are shown, to study methods.

Size of Business.—The business of selling cattle as breeding stock varies with the prosperity of the farmer. The volume of business for 1926 is only about one-third as much as was transacted in each of the years 1918, 1919, 1920. This fact illustrates that it is not wise to enter a business during a period of high prices and expect to dispose of the business before prices drop. The person who enters a business and stays with it through the years will have a few cattle to sell each year regardless as to whether prices are high or low. He is the one who will prosper.

Leading Fairs.—It is customary for breeders to exhibit their animals at a number of fairs and expositions each year. There are about seventy-five different state fairs throughout the United States and Canada. There are about eight nationally prominent fairs at which beef cattlemen exhibit their cattle.

American Royal Livestock Show, Kansas City.
Eastern States Exposition, Springfield.

Denver Fat Stock Show, Denver.
International Livestock Exposition, Chicago, (Fig. 71).
Iowa State Fair and Exposition, Des Moines.
New York State Fair, Syracuse.
Pacific International Livestock Exposition, Portland.
Southwestern Exposition and Fat Stock Show, Fort Worth.

Exhibiting Animals.—The reason for holding the fair is its educational value to the general public. The main purpose of the breeder and exhibitor is to sell his cattle. It is an honor to have animals win a prize at any fair. It is legitimate advertising to announce the awards in trying to sell cattle.

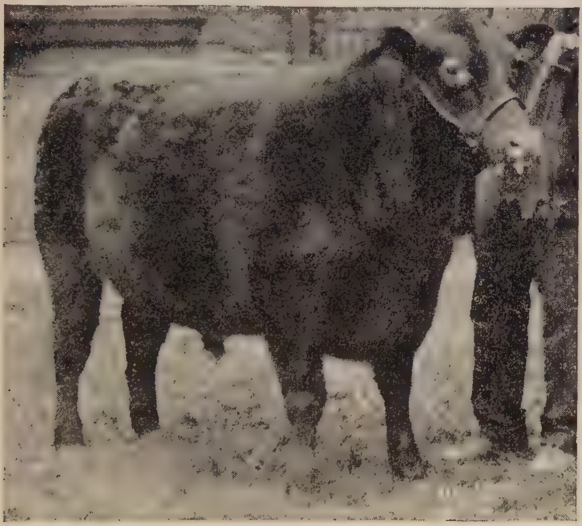


Fig. 71.—California Stamp, grand champion steer, International. Angus-Shorthorn cross. Bred by University of California. Live weight, 1070 pounds at 20 months of age. Dressed percentage 69.4; net weight 742 pounds.

In preparing animals for an exhibit, there are a number of common practices that can be followed. The good judge naturally likes to award the prize to one who is anxious to win. He is pleased to see the animal well trained to the halter, (Figs. 69, 70) properly groomed, with hoofs trimmed and polished, and the hair curled where this is possible. It is good to see an exhibitor who has interest enough in his animal to keep its feet in the best position while it is being judged. The hair may be curled or fluffed to cover up a weakness in thigh, loin or side. This is a legitimate practice but it does not deceive the judge. Such practices as putting paraffin below the skin or inflating with air to cover a low back, are usually detected by the judge. They are looked upon with disfavor and are not practised by reputable breeders.

The Field Man.—Agricultural newspapers usually employ livestock field men whose main business it is to sell advertising. The larger breeders carry small advertisements in the farm papers throughout the entire year, with larger ones just prior to holding sales. The field man usually makes one or two trips to the farm, and will publish two descriptive "ads" of the herd just preceding the date of sale, and also give a summary afterwards of the prices received and the persons buying the more prominent animals. The field man may also handle bids for purchasers who may not be present. He is familiar with pedigrees of the animals and is frequently called upon to mention what another animal of the same line of breeding may have sold for at a previous sale.

Public Sales.—Many breeders hold annual sales of their animals. If the volume of business in a given region is sufficient, breeders from a group of counties will arrange their sales in a circuit. The object of this is to attract larger breeders and induce them to attend a greater number of sales. Frequently the same auctioneers may work at these various sales. Males are usually sold a few weeks before the breeding season and cows are usually sold just prior to calving or with young calf at side.

Advertising.—Advertisements in newspapers frequently contain a cut or a photograph of a prize-winning animal. Ancestry and performance are prominently mentioned in the sale ring and in advertisements. The pedigree is often traced back for eight or ten generations to show a trace of inheritance from some noted ancestor. Bill-board advertising is good where the sign can be placed on a well-used thoroughfare. Many breeders advertise the kinds of cattle they have by painted signs on the barns. Frequently the name of the farm, the name of the owner and the breed name of the cattle are printed in large letters.

Preparation of the Animal.—Animals to be sold at a farm sale do not need as much care and preparation as those sold in connection with a fair or exhibit. They should be well trained to the halter. The hair should be well brushed but need not be washed and curled. The hoofs do not need to be polished. The horns may be polished to some extent.

Catalogs.—The most important group of animals in the sale should be listed first; e.g., bred cows, leaving heifers to be sold last. Pedigrees should be complete enough to include all near ancestors of recognized merit. Descriptive matter such as date of birth, date when bred, color and marking, and name of breeder and owner should be briefly stated.

A reputation for honesty and fair dealing is much to be desired. Any guarantee or promise concerning the animals sold should be kept to the letter. A satisfied customer is a good advertisement.

Job 13. Wintering Calves, Yearlings, and Breeding Animals

Conditions Usually Found.—(1) Many cattlemen feed a ration of grain and legume hay to calves in order that they may come through the winter in good condition of flesh. (2) Yearlings and cows are usually wintered on hay and fodder, the cows receiving an increased grain ration as the gestation period advances. (3) Some farmers allow their young stock and breeding animals to come through the winter in a thin and unthrifty condition.

Aims.—Students and breeders should know the best practices and methods in wintering these classes of beef animals.

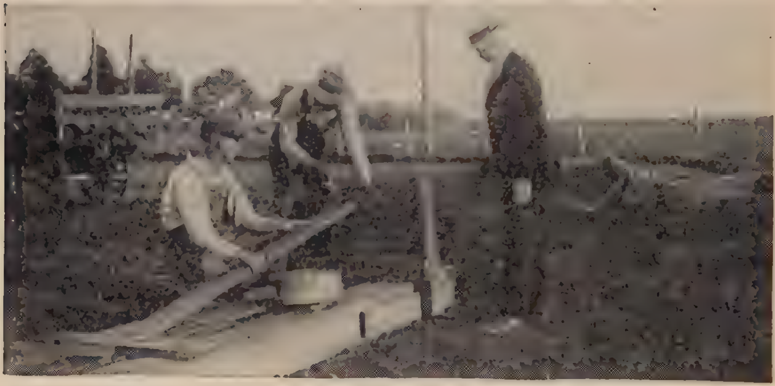
Problems for Study and Discussion.—(1) Study different conditions of wintering these cattle in the community and report them in class for discussion.

2. What hay and forage crops are commonly grown in your community?
3. Plan economical rations suited to the wintering of (a) calves, (b) yearlings and (c) cows.
4. Mention other feeds that need to be added.
5. What devices can one use to force these cattle to take the proper amounts of daily exercise?
6. Describe a common method of providing salt for these animals.
7. State the additional feeds that can be grown in small quantities to provide a variety to the general ration planned.
8. Give a review of several writers as to the value of silage for these classes of animals.
9. Describe a desirable method of watering cattle in cold weather.

Activities.—(1) Collect samples of silage from different farms and compare them in quality. (2) Collect winter roughage from different winter grain rations for animals of different ages and conditions. Compare these for their respective purposes. (4) Repair feed bunks and sheds preparatory to wintering the young stock (Figs. 72 and 73).

Kinds of Feed Needed.—Winter feeding of calves, yearlings and breeding animals calls for a consideration of the kinds of feeds needed, and plans as to the amount of flesh the cattle should carry the following spring. A daily gain in weight without a large accumulation of fat is a desirable condition.

There are three classes of feeds—proteins, carbohydrates and fats. In addition to these, each feed carries certain mineral elements that go to build bone in the animal. Examine tables showing the composition of feeds and you will see that these well-known feeds are relatively high in mineral content: oats, wheat, bran, linseed meal, dried corn leaves, blue-grass, buffalo grass, red clover and alfalfa hay. Carbohydrates are divided into the headings of crude fiber, which is practically indigestible, and nitrogen-free extract, which represents the digestible part of the feed. The carbohydrates and fats go to produce heat energy and form fat. Protein goes to form the muscle. Breeding animals and young growing animals should have rations containing the elements that will go to form bone and muscle. Much has been said about the value of sunshine for swine and poultry. These statements will no doubt apply equally well to beef cattle. Good silage is invaluable for wintering young stock and breeding animals. (Fig. 74). (See feed tables in Appendix.)



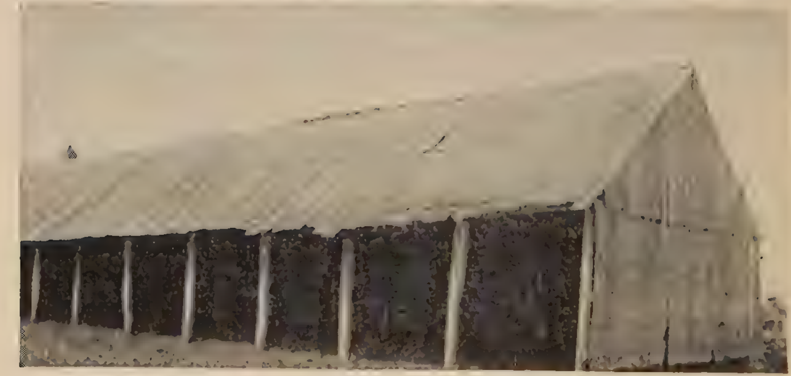


FIG. 72.—Vocational student and his father repairing feed bunk for winter feeding. (Ralph R. Bentley, teacher.)
FIG. 73.—Open shed for winter feeding in a mild climate.

Exercise is ever important. Forced exercise can be accomplished by separating the feeding quarters some distance from the watering place. In pleasant weather, hay and roughage feeds can be hauled out on the pasture, thus serving the purpose of giving animals exercise, reseeding the grass, and distributing the manure evenly.

Rations.—A study of the job of wintering animals needs to be connected with the decisions as to what crops to grow, and with the buying of concentrates and supplementary feeds. Alfalfa and sweet clover hay can be grown or obtained in many localities. Oats is one of the most widely grown of the grain crops. Some sort of silage, either of corn, kafir, or sorgo, can also be grown. The job then will be to take what home-grown feeds the student has and add others as they appear necessary and economical. Yearlings and two-year-olds are usually wintered on roughage. Calves should have from 1 to 3 pounds of concentrates daily, as cottonseed meal or linseed meal. A legume hay is desirable for all growing cattle. Silage is excellent feed for cattle, and if it contains a considerable amount of grain, little else need be provided other than a protein concentrate.

Fig. 74.—A silo assists greatly in winter feeding of cows and young stock.

Desired Weights.—Calves should weigh about 400 pounds at eight months of age. Yearlings at beginning of winter should weigh 725 to 750 pounds. Two-year-olds having the run of good pasture for the entire summer should weigh about 1000 pounds. Beef cows that have raised calves during the summer are frequently in thin condition at the beginning of winter. They may be expected to weigh 850 to 900 pounds.

Watering.—Cattle should not be forced to drink ice-cold water. During freezing weather they should be given water as it is pumped from the well, or they should have access to water that has been heated. There are tank heaters on the market giving excellent results.

Job 14. Buying Feeder Steers

Conditions Usually Found.—(1) Steers are usually fed in lots of one or more carloads each, twenty head usually constituting a carload. (2) A few cattlemen are so situated that they can grow or raise a load of cattle of a given age. (3) Others raise some cattle and purchase enough in the local neighborhood to fill out a carload. (4) Many persons go to the nearest central market and purchase the number of feeder steers wanted. (5) Banks will usually loan money with which to purchase cattle for fattening.

Aims.—Beginners should become acquainted with the principal factors to be considered in buying feeder steers.

Problems for Study and Discussion.—(1) How much should a feeder steer weigh when the fattening period begins?

2. Explain the importance of uniformity in a carload of steers.
3. Give the reasons why it may be profitable for one man to purchase a load to make **choice** steers, and why it may be profitable for another to buy a load to make **common** steers, if there is a market for all fat steers.
4. At what months in the year are feeder steers selling for the lowest market price?
5. Under what conditions is it profitable to pay more than the lowest market price for feeder steers of a given class?
6. How long is the average feeding period?
7. You may have to buy some additional corn; how many bushels should you have at the beginning to make the feeding venture profitable?
8. What factors govern the distance that it will pay to ship feeder steers?
9. In preparing a load of feeder steers for market, state the reasons why profit may be derived from (a) market for the corn on hand; (b) profit from hogs running with cattle; (c) margin; i.e., increase per pound of the selling price over the purchase price.
10. What is your nearest central market?
11. State the conditions under which either fall or spring buying of feeder steers may appear advisable.
12. Students should study the types of feeders found in the community. Report costs of animals and feed. Compare these with probable selling prices.

Activities.—(1) Practice judging feeder steers and those which are on feed. (2) Run a comparison of the gains and profits from a bunch of common steers and a bunch of choice steers. These may be on adjacent farms where the feeding practices are similar. (3) Make a chart showing seasonal variation in feeder-steer prices. (Figs. 75 and 76). Explain the probable cause of this variation. (See Drovers' Journal Yearbook).

Where To Get Steers.—Each year many cattle are shipped from range pastures of the West and Southwest to the terminal markets, where they are sold as grass-fat and as feeder cattle. Many range herds have been graded up until they are of superior type and quality. Farmers in the grain-sorghum and corn belts depend largely upon this type of cattle for fattening purposes. A few farmers raise enough cattle to make a carload. Others depend upon buying from their neighbors in selecting their feeders. In general, the farmer will go to the terminal market and select his own cattle. He may if he desires depend on a commission man to purchase the desired number for him.

Margins.—The terminal markets offer opportunity in selecting animals of the desired type, class, age, size and uniformity. The buyer has an advantage over the seller in that, if he does not find the cattle he wants, he can wait a day or longer until something appears on the market that suits his needs. The price the buyer pays for cattle will have a very great influence upon the profit to be derived at their sale. This

Slaughter- and Feeder-Steer Prices at Chicago by Grade Groups, Average 1921–24

(Dollars per 100 pounds)

MONTH	FEEDER-STEER PRICES BY GRADE GROUPS			SLAUGHTER-STEER PRICES BY GRADE GROUPS		
	750 Pounds Up			1100–1300 Pounds		
	Fancy	Good and Choice	Common and Medium	Choice and Prime	Good and Choice	Common and Medium
January	$7.96	$7.39	$6.38	$10.88	$10.30	$7.83
February	8.10	7.46	6.40	10.60	10.12	8.04
March	8.52	7.79	6.79	10.38	9.94	8.14
April	8.48	7.80	6.71	10.06	9.67	8.01
May	8.90	8.15	7.12	10.06	9.69	8.22
June	8.54	7.75	6.62	10.04	9.68	7.96
July	8.14	7.40	6.22	10.40	9.94	7.89
August	8.10	7.28	6.00	10.91	10.30	7.70
September	8.13	7.31	5.96	11.10	10.40	7.51
October	7.74	7.02	5.83	11.66	10.92	7.63
November	7.48	6.81	5.64	11.70	10.94	7.45
December	7.52	6.68	5.76	11.69	10.98	7.66

Margin Between Fancy Feeder Steers and Choice and Prime Slaughter Steers Five Months Later

	MONTHS WHEN FEEDERS ARE BOUGHT											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	$	$	$	$	$	$	$	$	$	$	$	$
Choice and prime slaughter steers 5 months later	10.06	10.04	10.40	10.91	11.10	11.66	11.70	11.69	10.88	10.60	10.38	10.06
Fancy feeders	7.96	8.10	8.52	8.48	8.90	8.54	8.14	8.10	8.13	7.74	7.48	7.52
Margin	2.10	1.94	1.88	2.43	2.20	3.12	3.56	3.59	2.75	2.86	2.90	2.54

Margin Between Good and Choice Feeders and Good and Choice Slaughter Steers Five Months Later

	MONTHS WHEN FEEDERS ARE BOUGHT											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	$	$	$	$	$	$	$	$	$	$	$	$
Good and choice slaughter steers 5 months later	9.69	9.68	9.94	10.30	10.40	10.92	10.94	10.98	10.30	10.12	9.94	9.67
Good and choice feeders	7.39	7.46	7.79	7.80	8.15	7.75	7.40	7.28	7.31	7.02	6.81	6.88
Margin	2.30	2.22	2.15	2.50	2.25	3.17	3.54	3.70	2.99	3.10	3.13	2.79

Margin Between Common and Medium Feeder Steers and Common and Medium Slaughter Steers Five Months Later

	Months When Feeders Are Bought											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	$	$	$	$	$	$	$	$	$	$	$	$
Common and medium slaughter steers five months later...	8.22	7.96	7.89	7.70	7.51	7.63	7.45	7.66	7.83	7.04	8.14	8.01
Common and medium feeders...	6.38	6.40	6.79	6.71	7.12	6.62	6.22	6.00	5.96	5.83	5.64	5.76
Margin.........	1.84	1.56	1.10	.99	.39	1.01	1.23	1.66	1.87	2.21	2.50	2.25

Fig. 75.—Two-year-old feeders from Kansas pastures shown at the Iowa State Fair.

brings up the question of "margin," by which term we mean the difference in price per pound between feeder and slaughter steers. The following tables taken from a report of the Bureau of Animal Industry, U. S. Department of Agriculture, show very well indeed the margins for the different classes of cattle.

Type to Buy.—The length of feeding period is about 90 days for a short feed and 180 days for a long feed. The average feeding period is about 150 days. The smaller, thinner cattle make cheaper gains than larger cattle. A farmer having a supply of grass and forage crops can afford to buy common and medium grade cattle and take advantage of growth and the earlier gains that can be made on some corn and a considerable amount of roughage. The average two-year-old steer will eat about 45 bushels of corn during the fattening period. There will be some variation due to the amount and kind of supplementary feed given.

Time to Buy.—Winter feeding can be most profitably carried on where steers are purchased in the fall and are allowed the run of fall pastures and stalk fields before being placed on feed (Figs. 75 and 76). Feeder steers are usually high in price in the spring. It is not advisable to buy at this time unless you have plenty of grass or expect to carry out summer feeding. Feeder steers are usually bought as close to home as is possible in order to cut down transportation charges. Slaughter steers are often shipped considerable distances to take advantage of a favorable market.

Fig. 76.—Good-quality yearling-steer feeders from native pastures of Texas; shown at Iowa State Fair.

Job 15. Feeding Beef Cattle for Market

Conditions Usually Found.—(1) During the winter period, feeder steers are usually started on a ration of corn fodder. Grass-fed steers are usually started with a grain ration as they are turned on the pasture. (2) Each farmer decides for himself whether he will make a long or short feed. (3) Successful feeders watch closely the appetites of the animals and the laxative effects of the feeds they are using. (4) Some feeders do not exercise good judgment in "finishing" cattle for market. (5) All the corn they will eat is frequently the principal ration used in fattening cattle.

Aims.—Beginners should learn the skills and judgments necessary in the successful feeding of beef cattle.

Problems for Study and Discussion.—(1) What is the average length of feeding period for beef cattle?

2. Describe what is meant by cattle being on "full feed."
3. Under what conditions is it advisable to use a self-feeder for grain for cattle?
4. Describe the arrangement of equipment in an average feed lot as regards exposure, location of (a) shed, (b) feed bunks, (c) hay racks, and (d) water tank.
5. What is the cheapest of all feeds for beef cattle? Why?
6. State what is meant by "finishing" cattle.

7. Give the reason for the more expensive gains of the finishing period, as compared with the lower cost of gains in the earlier period of feeding.
8. What is the most profitable weight of shoats to be turned into the feed lot to follow steers?
9. How many hogs are needed per steer?
10. How many hogs can be fattened in the five months period?
11. Learn to interpret experiment-station results in beef-cattle feeding and to apply these results to the solution of local problems.

Activities.—(1) Contrast by trial (a) two different rations in feeding, (b) two different periods of feeding, (c) two different breeds.

How to Start.—In winter corn-belt feeding of beef cattle for market, it is usually the plan to allow the steers to consume the aftermath or second growth of the hay meadows, and the stalk field after the corn has been husked, before any attempt is made to start the fattening process.

The purpose of fattening is to improve the quality of the meat rather than to increase the size and quantity. As the animal eats more than is necessary to maintain the bodily activities, this extra feed is stored around and between the muscles and tissues in the form of fat. This gives the desired marbling effect and adds juiciness to the meat. Corn and grain sorghums are the principal fat-producing feeds.

FIG. 77.—Vocational students studying methods of feeding and managing steers. Feed bunks made by students.

The average feeding period is about five months or 150 days. Cattlemen usually plan the approximate time the cattle will be sold and start their feeding operations accordingly. Summaries from the markets at Chicago show that the three grades of *prime, choice* and *good* steers bring the lowest prices of the year during the months of April, May and June, the months during which the bulk of the winter-fed steers are marketed. An explanation of this is made in the marketing job.

Getting on Full Feed.—The process of fattening is usually started by feeding the animals corn fodder, stalks with the ears attached, and clover or alfalfa hay. The appetite of the animal is good and considerable quantities of roughage will be eaten in the earlier stages of feeding. (Fig. 77). Well-cured corn fodder possesses an odor and palatability that the steer relishes. By husking the corn from a few shocks, one can quite accurately estimate the pounds of grain in a definite amount of fodder. As the need for additional grain increases, one can add husked or snapped corn in the quantities desired.

In using the expression "getting the animal on full feed" the breeder means getting the animal through the period of greedy appetite, and rapid gains, in which a certain amount of fat is stored in all parts of the body, to the stage of eating the maximum amount of feed and making slower but steady daily gains. Henry, in "Feeds and Feeding," says that "Mumford recommends that cattle going on full feed be given all of the clover and alfalfa hay they will eat without waste. In addition, start with two pounds of corn per steer per day, increasing one pound daily until ten pounds are fed. After three days increase one pound daily until seventeen pounds are fed; 15 days later let this be increased to about 22 pounds daily. Cattle getting from 12 to 15 pounds of corn daily should have about 12 pounds of clover or alfalfa hay per 100 pounds of live weight; later only about one-fourth of the ration should be roughage."

Corn-Belt Ration.—A standard corn-belt ration per head daily when on full feed, recommended by the Iowa Station, is as follows:

Shelled corn, 14 to 18 lbs.
Corn silage, 27 to 35 lbs.
Linseed meal or cottonseed meal, 3 lbs.
Clover or alfalfa hay, 1 to 2 lbs.
Block salt at will.

Without the use of corn silage, that station recommends 16 to 20 pounds of corn, 8 to 10 pounds of clover hay, and 1.5 to 2 pounds linseed meal. In the corn belt, farmers use either linseed meal or cottonseed meal or cake. The question of cost will largely govern their respective uses. In the cotton belt there is no doubt that the cottonseed meal is more economical to feed. Grain sorghums for grain, and kafir and the sorgos for silage, are the substitutes for corn and corn silage for feeding cattle in the arid and semi-arid regions.

The finishing of cattle is described as being the latter part of the feeding period where the appetite has reached its maximum. They are eating a large amount of grain and a small amount of roughage. The increase in body weight consists of a high percentage of fat and a low percentage of water content of the feed. Sometimes molasses or similar feeds need to be added to keep up the appetites of the animals.

Weight of Hogs.—Hogs weighing 100 to 150 pounds are the most profitable to follow steers. Fat hogs are not desirable because they become too lazy to pick up the grain. Sows and pigs should not have the run of the feed lot. Any shoat weighing less than 50 pounds is liable to injury in the feed lot. The number of hogs to follow steers varies with the kind of feed, the way it is prepared, and size and age of cattle. The range downward is from 2 to 3 hogs per steer on snapped corn, 3 hogs to 2 steers on husked ear corn, 1 hog per steer on shelled corn, and 1 hog to 2 or 3 steers on ground corn.

Management of Hogs.—It may be possible to feed two groups of hogs with a given lot of steers (Fig. 78). Much, however, depends upon the size of the hogs at the beginning of their feeding period. Whatever in feeds or methods favors the rapid growth of steers will also favor the growth of hogs. A bit of helpful management may be accomplished by feeding hogs the extra corn before feeding the cattle. This will keep the hogs out of the way of the team and wagon.

Fig. 78.—Heavy steers ready to be closely graded and loaded for market. Swine running with steers save much grain.

Job 16. Marketing Cattle for Beef

Conditions Usually Found.—(1) Some farmers do not ship their cattle until they are finished, regardless of the market price they may receive. Others aim to sell on the highest market even if their cattle are not in the best condition. (2) Carload lots of cattle are usually shipped by the farmer direct to a commission firm. (3) Individuals who do not consign their shipments direct to a commission firm are forced to pay handling charges to one or more middlemen. (4) Coöperative marketing sometimes offers an advantage by lessening the handling charges and other services in marketing beef cattle.

Aims.—Students should become acquainted with all the steps connected with the marketing of beef cattle. (2) They should know the advantages of different methods.

Problems for Study and Discussion.—(1) State the precautionary feeding measures that should be taken before loading slaughter cattle in a car for shipment.

2. How far apart are the feeding stations that serve the cattle as they are shipped long distances?
3. Describe the steps in handling and selling of cattle in the terminal markets.
4. What group of farmers or feeders profit most through the services rendered by coöperative marketing?
5. Name the duties and qualifications of a manager of a coöperative shipping association.
6. Describe the methods of marking, weighing, and pro-rating of receipts and expenses in a coöperative livestock shipping association.
7. What are the effects of a large run of fat cattle on the market for a given day?

8. When is it best to decide the approximate date for marketing a given load of slaughter steers? Name the factors that must be considered.
9. In what months in the year is it best to sell choice feeder steers? Why?
10. When is it best to sell common to medium steers? Why?

Activities.—(1) Practise sorting cattle for shipment. (2) Write letters ordering cars for loading. (3) Fill out bills of lading and shipping orders. (4) Assist in loading cattle in cars. (5) Graph prices of cattle of different grades and for several years using figures from the Drovers' Journal Yearbook.

Marketing Talk.—After this job has been studied, have a successful beef-cattle breeder or feeder appear before the class and talk on marketing problems.

This job is intended to cover the marketing of thin or young cattle to be sold as stockers or feeders, and the marketing of fat cattle, which may include dry cows, heifers, or steers.

Preparing for Shipment.—Consider the animals from the time they leave the farm or ranch and study them until they are sold on the open market at such places as Fort Worth, Kansas City, Omaha, and Chicago. In many instances cattle are driven long distances to the railway loading station. Their preparation for shipment is largely the same whether they are to go for feeder or for slaughter purposes. Cattle should arrive at the terminal market in such condition that they will eat readily, drink a good fill of water, and show a minimum shrinkage. The attainment of this condition depends upon their preparation, which should begin two days before shipment.

The ration should not be changed, other than by adding a small amount of oats and substituting timothy hay for green grass and silage. Do not add salt just before shipping. This may cause the cattle to drink too much water and be uncomfortable en route. If the distance to the loading station is short and the shipment of only a few hours duration, they should not be watered immediately before loading. If the shipment is to require 36 hours or a greater part of that time, they should be treated so as to take a normal feed of grain and hay and a normal fill of water just before loading. (Fig. 78.)

Loading the Car.—Bed the car well, using straw or shavings for winter, and wet sand for summer. Wire hay along the sides of the car. Avoid squeezing, but load to capacity as a full car rides better than one partly filled. If possible, cattle should be loaded long enough to get quiet before the train starts. Usually, however, the engine places the car and moves it away as soon as it is loaded. U. S. Farmers' Bulletin 811 gave a table showing "Approximate number of cattle and calves that can be shipped in railroad cars of various lengths."

Length of Time of Shipment.—Certain laws governing the shipment of cattle impose a fine upon the railway company if the car is

Approximate Weight	36-Foot Car	38-Foot Car	40-Foot Car
400 pounds	45	48	52
600 pounds	38	40	42
800 pounds	30	32	34
950 pounds	27	28	30
1050 pounds	25	26	27
1150 pounds	22	23	24
1200 pounds	20	22	23

delayed beyond certain hours. If the delay occurs the company is obliged to unload the cattle for feed and water. Twenty-eight hours of time is the minimum, with the provision of an extra eight-hour release that may be granted by the shipper. This makes a total of 36 hours for a given shipment. It is customary for the shipper to grant such a release. Cattle are expected to arrive at a terminal market not later than 2:00 A.M. on the morning of the day they are to be sold. Railway companies plan to ship as far as 500 miles within the 36-hour limit. This means that cattle intended for the market on Monday morning must not be loaded before 2:00 P.M. Saturday afternoon. Special days are usually designated as shipping days, and through main-line trains are provided in order that shipments may arrive at the desired time.

Consignment to Commission Firm.—Prior to shipment, the cattle are consigned to some commission firm which attends to the selling and sends the money in the form of a bank draft to the owner. Upon arrival at the yards the cattle are unloaded and placed in a pen where they have access to all the hay and water they will consume. The selling is done by a representative of the commission firm who deals directly with the buyer for the packing house, the man who is buying for export shipments, or the farmer who is buying for grazing or feeding. Cattle intended for immediate slaughter are usually killed the same day they are sold on the market.

Coöperative marketing has not attained such proportions with beef cattle as with many other commodities. Persons feeding less than carload lots profit most through coöperative marketing. The local buyer who makes a business of shipping livestock renders a service to this same group of feeders as would profit by coöperative marketing. If the farmer believes the local shipper is deriving too large a profit for the service rendered, he, the farmer, has the opportunity to combine with some other person to make out a carload shipment or join a coöperative shipping association. The purposes of such an association are to benefit from increased shipping facilities, to dispense with the services of the local buyer, and to market in larger and more uniform quantities. The financial success of the organization depends largely upon the man who is chosen as manager and upon the loyalty of the members. In the larger associations, the manager is usually given a straight salary, although he may be paid a certain rate for each car of livestock shipped. The manager should be honest, capable, aggressive, and well informed in matters of shipping livestock. At present the greater amount of organization is at the producing end. There are some organizations effectually carrying on coöperative selling work. Among these are the Coöperative Producers Company, Farmers Union, Farmers Equity, and Farm Bureau. These organizations are operating in a number of the principal livestock markets.

In coöperative shipments, the cattle are usually marked by clipping numerals in the hair of the rump. The shipping costs and selling charges must be pro-rated. There is usually an additional selling charge where a mixed load is sold, because of extra weighing and separate accounts.

When to Sell.—The job of selling the slaughter steers is an important one. It is possible for a person to study the markets over a period of years and by summaries to be able to predict the probable price his animals will bring when placed on the market in any given month. The Bureau of Animal Industry of the U. S. Department of Agriculture published a mimeographed bulletin giving the average prices by months for slaughter steers at the Chicago market.

Slaughter-Steer Prices at Chicago 1100–1300 Pounds, Average 1921–24

Dollars per 100 pounds

Month	Grade of Steers			
	Choice and Prime	Good	Medium	Common
January	$10.88	$ 9.74	$8.52	$7.12
February	10.60	9.70	8.67	7.37
March	10.38	9.64	8.68	7.56
April	10.06	9.36	8.48	7.47
May	10.06	9.39	8.54	7.77
June	10.04	9.36	8.52	7.45
July	10.40	9.66	8.61	7.26
August	10.91	9.91	8.52	6.86
September	11.10	9.94	8.30	6.50
October	11.66	10.33	8.50	6.29
November	11.70	10.30	8.36	6.07
December	11.69	10.36	8.54	6.46

Effect of Grade on Prices.—It will be noted that the highest price for common steers is for the months of April, May and June. This group consists of animals of poor quality and finish. Many of them are no doubt shipped out to farms again to be placed on pasture or for summer feeding, thus making a scarcity of this type of steers for slaughter purposes. The lowest price is shown for the months of October and November, with a rise beginning in December. This is accounted for by the grass-fat cattle from the ranges being placed on the market at that time.

Medium-grade steers are lowest in price during October, November and December. They are given a short feed after being taken off grass or in some instances may be sold as grass-fat steers. They are only fair in quality and are not suitable for taking a long feed. Because of this, they bring the highest price during January, February and March when there are fewest of them on the market.

Good, choice and *prime* steers are lowest in price during April, May and June. This represents the large group of steers fed by farmers who have a fixed time of feeding and need to get the steers out of the way in order to devote their labor to the summer work on the farm. Very few of these steers are on the market during October, November and December, and the price is then the highest. Being higher grades of steers, they are suitable for long periods of feeding. In order to meet this highest market, these steers should be placed on feed about July 1. Very few farmers have enough old corn to feed a load of steers from July until some time in October when it is safe to transfer to new corn. This accounts for their period of high prices.

Job 17. Butchering and Running Beef Ring

Conditions Usually Found.—(1) A beef ring is often organized in a rural community for the purpose of supplying fresh beef over an extended period. (2) Butchering is sometimes done by the members or by others employed for the purpose.

Aims.—(1) Young farmers should know how to butcher a beef and to cut up the carcass in an efficient manner. (2) They should learn how to manage a beef ring.

Problems for Study and Discussion.—(1) What tools and equipment are necessary in butchering a beef on the farm?

2. In shooting a beef, how do you locate the spot at which the bullet should be aimed?
3. Describe a method of tying the beef preparatory to stunning.
4. How should the butcher bleed a beef?
5. Describe the process of skinning and the removal of the viscera.
6. Tell how to cut up the carcass so as to obtain the desirable cuts of meat.

Visit a meat shop and study the wholesale and the retail cuts of beef and of veal.

Activities.—(1) Make a wall chart showing the cuts of a beef carcass. (2) Assist in killing, skinning and butchering a beef. (3) If possible practise cutting meat for retail use. This may be done at a meat shop or after butchering has been done elsewhere. (4) Draw up blanks for a local beef ring. (Fig. 79.)

Purpose of Beef Ring.—The organization of a beef ring usually consists of a gentlemen's agreement between a few neighbors, that each will in turn butcher a beef, usually a heifer calf, and sell parts to the other members. The meat not taken by the members is sold to others in the community. The first animal is usually killed as early in the fall as the nights begin to be uniformly cool.

Killing.—The farm butchering of beef is not as common as with hogs, because of the size of the carcass and the difficulty of curing. The necessary tools are not many. The wood saw, the chopping axe, and the housewife's butcher knife may be substituted for the meat saw, cleaver and special knives. A wooden gambrel stick of strong tough wood, a tripod made of 12-foot poles or 4″ x 4″ pieces and a block and pulley and rope constitute the minimum tools. The animal may be killed either by shooting or stunning. Stunning is desirable if the animal can be tied and held in position long enough to strike the blow with the ball of an axe. The animal is rendered unconscious, and bleeds freely if it is stuck immediately. In shooting, the death is instantaneous and the bleeding may not be as free as is desired. Sticking or bleeding is usually accomplished by making two incisions in the throat, one parallel with the neck and the other across the throat, and inserting the knife into the jugular vein.

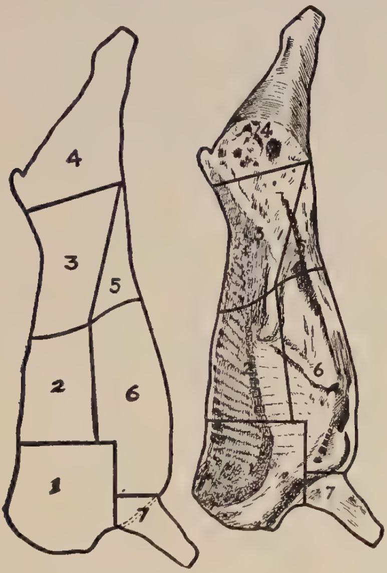


Fig. 79.—Cuts of beef: (1) chuck; (2) rib; (3) loin; (4) round; (5) flank; (6) plate; (7) shank.

Skinning.—The head and legs should be skinned as the animal lies on the ground. Then the hide should be cut along the center underline of the body. Attach the block and pulley to the hind legs and elevate the animal on the tripod until the head clears the ground. Next cut off the head to allow free bleeding. To remove the hide, begin with the hind quarters and work downward around the body using care not to cut holes in the hide.

Cutting up Carcass.—The viscera or entrails should be removed, care being taken not to cut any part of the intestines or digestive tract. As these organs are being removed, the downward pressure of their weight should be sufficient to remove them from the carcass. A gentle outward pull will sometimes assist. The carcass is cut in halves and again into quarters. Under farm conditions, this is about all the division necessary. If, however, the quarters are too large, the divisions should be made into the seven recognized cuts: chuck, rib, loin, round, flank, plate, shank.

Job 18. Keeping Records

Conditions Usually Found.—(1) Only a few persons keep complete records of feed and labor cost in caring for cattle. (2) Some farmers keep a record of the original purchase price of the animals, and a record of the cash expense for additional feeds purchased. (3) Many cattlemen do not record the cost of their own labor or the cost of home-grown feeds that are used in their beef cattle operations.

Aims.—A simple plan for keeping cost account records of beef cattle should be understood and used by farmers.

Problems for Study and Discussion.—(1) Why should an inventory of animals in the herd be made each year?

2. Why should feed on hand be included in this inventory?
3. Would you use the original cost or the present value of animals? Why?
4. Ask beef cattlemen why they do or do not keep cost records.
5. How many of them make an annual inventory?
6. State what is meant by the following: cost of production, labor income, gross income, net profit or loss, cost per unit of production.
7. Describe two systems of record keeping that may be used in rendering an income-tax report.
8. Find by inquiry how beef enterprises are financed in your region.
9. Compare different methods as to effects on profits.

Activities.—(1) Draw a form in a suitable blankbook for keeping a labor record for a year in the beef enterprise. (2) Draw another form for a feeding record for a year. (3) Draw a form for keeping records of miscellaneous expenses. (4) A fourth form should be drawn for keeping a record of sales for a year. (5) Fill all of the preceding forms either on your own or a neighbor's place. (6) Get blank income-tax forms from the Internal Revenue Office and fill them for your own or some other place.

Need for Records.—High-school boys planning to become farmers should think of farming as a business, and learn to use business methods in the operation of a farm. The average person cannot trust the memory to serve him, except in a few instances where great interests are involved.

Many items, as exchange of labor, weights, weather, conditions of rainfall, first and last killing frosts of a season, prices of receipts and sales, dates of personal notes, etc., should be kept. Canceled checks are very valuable as receipts, but these need to be supplemented by a daily diary in which the items are recorded at the end of each day's work. A ten-cent note book will serve for keeping daily records.

Value of Records.—The present internal-revenue law regarding income tax has done more than any other one thing to cause farmers to keep farm records. The value of accurate records in presenting an income-tax report cannot be overestimated. The plan of the individual project includes a provision for inventory, labor, and feed records. Two years of this work usually convinces the student of the value of records and assists him to form a habit of making entries at the proper time. Habit plays a great part in the keeping of records. The following forms are simple yet adequate for practically any farm condition.

Annual Inventory.—In each farm enterprise it is important that the equipment available at the beginning of the enterprise should be recorded in a list called an inventory. At the end of the year the inventory should be gone over again in making a new list. The comparison of the two will show how much the list and its valuation have increased or decreased during the year. If it has increased the enterprise must be credited; if it has decreased the enterprise must be charged with the difference.

In making up each list include the kind of property, number or quantity, the price of each unit, and the value. The list may include livestock, feeds, buildings, tools, and notes you hold. Deduct notes you owe. Use actual market values at the farm as nearly as possible. If livestock are born during the year, these dates should be recorded in a table to aid in making the inventory at the end of the year. They will not be given any value until the end of the year, or when they are sold. Their value will be offset by the feed consumed.

Inventory

Items	Beginning of Year			Close of Year		
	Quantity	Price	Value	Quantity	Price	Value
	Total..........		$	Total..........		$
Net increase or decrease for year...............			$			$

Farm Labor Record

Date	Kind of Work	Self		Others		Horse		Tractor	
		Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost
Total Expense									

Enter in the labor record all labor connected with the enterprise, whether it be for chores, other productive labor, marketing or miscellaneous. Divide the labor into the headings shown above.

Feed Record

Date	Kind of Feed	Quantity	Price per Unit	Value

Record all feed purchased for the herd at the time of purchase. Record also each delivery of feed for herd purposes, raised on the farm. When the silo is filled or when a crib of corn is to be used entirely for the cattle enterprise, it can all be charged at one time on the books. Smaller lots will need to be entered from time to time.

Miscellaneous Expenses

Date	Item	Quantity	Price per Unit	Cost

Miscellaneous expenses include rent, interest, insurance, taxes, and livestock purchased.

Receipts.—This record should include all sales, notes paid, credits for natural increase in herd, and manure credits.

Receipts

Date	Item	Quantity	Price per Unit	Value Received

Summary Statement.—From the former records it is easy to make a summary at the completion of the year (or enterprise cycle) for each enterprise. For this purpose rule a page as shown.

Summary Statement

Expenses	Amt.	Receipts	Amt.
Inventory beginning of year..........		Inventory end of year................	
Miscellaneous expenses...............		Receipts—Cash........................	
Hired labor..........................		Used for feed........................	
Horse labor..........................		Used in home.........................	
(1) Self labor.......................			
(2) Total cost.......................		(4) Total income.....................	
(3) Less self labor, (2) minus (1).....		(5) Net income, (4) minus (2)........	
		(6) Labor income, (4) minus (3)......	

The net profit is the difference between the total receipts and total expenses. Such items as machinery charges may be added to the labor record. The use of machinery is usually taken care of in the depreciation in value as shown in the inventory at the end of the year. The summary is made up from the other accounts at the end of the season or end of the project.

Types of Records.—For income-tax returns, one may choose between the inventory method and the cash-receipts-and-expenses method. A person reporting upon one basis may change to the other form. Once changed, a person is obliged to continue with that method. The inventory or accrual method is much the more accurate and complete.

Station Circulars and Bulletins.—Illinois Circ., 296; Iowa Extension Bul., 73, 74, 78, 80; Bul. 181; Circ., 72, 75, 80; North Dakota Extension Circ., 47; South Dakota Bul., 154.

HORSE AND MULE ENTERPRISE

By Sherman Dickinson, Ph.D.

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Analysis into Jobs.—The following twelve jobs include the chief managerial and operative undertakings with horses and mules. References are to numbers of U. S. Farmers' Bulletins. See *Productive Horse Husbandry* by Gay; *Diseases of Horses*, U. S. Bu. Animal Industry.

1. Deciding the needs and possibilities in the horse and mule enterprise. Bul. 803, 952, 1295, 1296, 1298, 1341.
2. Understanding the characteristics of various types and breeds. Bul. 619, 952.
3. Selecting indivisuals. Bul. 619, 779, 803.
4. Providing barns for horses and mules.
5. Raising the colts. Bul. 803, 1030, 1167, 1341.
6. Growing and training young stock. Bul. 1368.
7. Feeding mature horses and mules. Bul. 803, 1030.
8. Caring for work stock; knowing management details. Bul. 1419.
9. Maintaining the health of horses and mules. Bul. 954, 1146, 1419, 1503.
10. Using work stock most efficiently. Bul. 1295, 1296, 1298, 1419.
11. Improving horses and mules. Bul. 803; U. S. Dept. Bul. 905.
12. Marketing horses and mules. Bul. 1144, 1341.

Job 1. Deciding Needs and Possibilities in the Horse and Mule Enterprise

Conditions Usually Found.—(1) There is a fairly steady demand for horses and mules in many parts of the country. (2) Colts may be profitably produced as a side line on many farms. (3) In most communities there is a shortage of first-class breeding stock. (4) Many farms are understocked with *good-quality* work animals.

Aims.—Students should consider demands, prices, expenses, possible losses, labor, capital requirements and other factors before deciding to enter upon this enterprise.

Problems for Study and Discussion.—(1) To what extent are the old work animals in the community being replaced by animals raised locally?

2. What effect has the use of automobiles, tractors and trucks had upon the local horse business?
3. How well are the horses and mules used in the community adapted to the work for which they are used?
4. What is the cost of raising a colt to three years of age under local conditions? Is it wiser to raise or purchase?
5. What has been the local tendency in work-stock production during the last ten years?
6. How do you account for the situation in your state as shown in the table?
7. To what extent will tractors and trucks finally displace horses and mules in cities and for farm work?

8. What effect will motorization have, through use of automobiles, trucks, and tractors, upon the quality of work stock?

Debate: Horses (or mules) vs. mechanical power for farms.

Activities.—(1) Make a survey which will show the local situation as regards horses and mules. See the suggested form on a following page and adapt it to local needs. (2) Tabulate figures from farmers showing the cost of raising a colt to three years of age under local conditions. See table in this section for items to be considered.

Importance of Job.—Before deciding upon conducting any enterprise in farming, the operator must consider the requirements of the enterprise and its possible outcome in terms of profit to himself. He should understand the present situation as to the market demands for the product and the possibilities as to the future requirements.

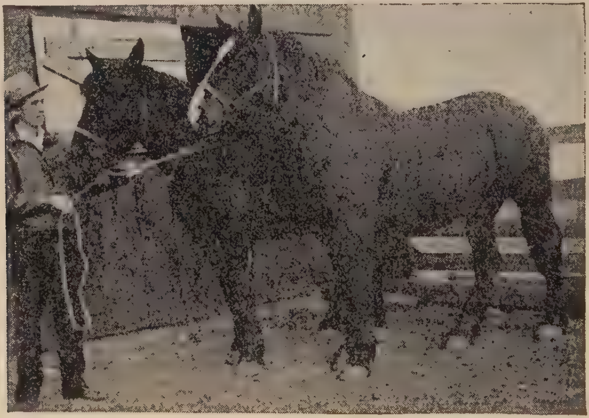


Fig. 80.—Kenneth Powell, vocational agriculture student of Butler, Missouri, with his horse project consisting of two two-year-old Percheron fillies. These animals weigh about 1400 pounds and are valued in the project records at $175.00 each. (L. D. Maddox, Teacher.)

In studying the horse and mule situation, one should know the character of the demand for work stock, the present supply as to quantity and location, the effect of motorization, and the probable costs, risks, and returns to be expected.

The Types of Horses and Mules.—The type in greatest demand and in which there is the largest margin of profit for the producer is the draft type. (Fig. 80). In the southern sections of the United States, however, horses and mules of a medium size are still desired for farm work. (Fig. 81). Horses of all types are needed for breeding purposes in supplying the market with draft animals, road horses, and army mounts. Both city and farm requirements are fairly steady though differing in character. Two types of horses are wanted for city use, the medium-weight delivery horse and the extremely heavy horse for large loads on short hauls. Both types are desired with as much quality as possible. The horse or mule for the farm trade is the medium-sized and blockier animal with less attention given to quality. Both trades demand "serviceably sound" animals.

Present Supply.—Considering the country as a whole, there appears to be a shortage of good work stock, a shortage which seems likely to continue. The data presented in the accompanying table show this situation.

Fig. 81.—Vocational agriculture students of Belton, Missouri, showing project mules at the local fair. J. L. Campbell, Teacher.

It may be seen from the table that it will take many years to bring the horse population to the stage where the supply is commensurate with the present requirements. This is of interest to the farmer, whether he is a buyer or a seller of work stock; in both cases, it *may* be a profitable undertaking to produce colts.

Effect of Motorization.—Gay says, "Notwithstanding the keen competition between the horse and the motor in some fields, the horse business in general is on a sound basis and bids fair to continue so, as far as can be foreseen." There are no doubt certain types of work both in town and in the country in which the truck and tractor are more efficient than the horse. It is just as true, however, that horse labor is still indispensable. It is reasonable to expect that the motorization of industry

Years Required to Replace Present Horses at Present Rate of Breeding

(1925 Census, arranged by Frame, University of Missouri)

STATES	NO. OF HORSES ALL AGES	% OF ALL HORSES IN U. S.	COLTS UNDER 2 YEARS	NO. OF YEARS TO REPRODUCE HORSES
Less than 15 years				
Ariz., Mont., N. Mex., Nev., Wyo.	1,143,041	6.9	171,360	13.3
15.1–20 years				
Fla., Miss., Tenn., Utah	537,943	3.3	63,081	17.1
20.1–25 years				
Col., Idaho, Ia., Ore., S. Dak.	2,740,904	16.6	250,036	21.9
25.1–30 years				
Ga., Kan., Ky., La., Nebr., N. Dak., Okla., Tex., Wash.	4,732,109	28.6	343,397	27.6
30.1–40 years				
Ark., Ala., D. C., Ill., Md., Minn., Mo., Va., W. Va., Wis.	3,997,903	24.2	234,747	34.1
40.1–60 years				
Cal., Del., Ind., Mich., Ohio, S. Car.	2,074,646	12.5	95,076	43.6
60.1–100 years				
N. Car., N. Y., Pa., Vermont	1,055,574	6.4	32,691	64.6
Over 100.1 years				
Conn., Me., Mass., N. Hamp., N. Jersey, R. I.	253,639	1.5	3,573	142.0
Total	16,535,759	100.	1,193,601	27.7

may in itself bring about a greater demand for horse labor as a necessary supplement to such motorization.

The Costs.—The total cost incurred in producing horses is governed very largely by the conditions existing on the farms where the animals are raised. Inasmuch as horses are usually produced as a side line on general farms, very little can be charged to overhead. The dams are kept primarily for the farm work, so that only a small proportion of the cost of feed, shelter, and care of the mare should be charged to the colt. If the farm provides plenty of good pasture land, the cost of rearing colts to marketable age is somewhat reduced. No unusual risks are to be expected in rearing colts. Given satisfactory feed and kept under sanitary conditions with opportunity for plenty of exercise, there is little to be feared other than accidents. A foolish colt may injure itself; any colt may be struck by lightning; but in general, the risk is not great.

Figures published by Cornell Station and reproduced here are the result of careful study over a period of ten years, with 34 mares and 82 colts involved. Prices are for the war period.

Itemized Statement of Cost of Raising a Colt

Service fee			$ 15.00
Inconvenience and time lost by mare, 10 days at $1.00			10.00
Risk and insurance	Mare $200, 3% risk		6.00
	Colt $40, 20% risk		8.00
	Yearling $70, 1.5% risk		1.05
	2 year old $120, 1.5% risk		1.80
Veterinary services and supplies			2.00
Care and shelter	First year		5.00
	Second year		7.50
	Third year		7.50
Feed	First year	Grain	19.51
		Hay	9.57
	Second year	Grain	21.10
		Hay	15.15
	Third year	Grain	26.57
		Hay	16.74
Pasture	First year		2.50
	Second year		5.00
	Third year		7.50
Total			$187.49
Credit half cost third year for work			29.15
Net cost of three-year-old			$158.34

In writing on the horse situation in August, 1923, W. H. Peters of the Minnesota Station made the following statements:

> Horse production is declining at a rapid rate throughout the world and in the United States. The number of horses required to do the work of the country is also declining, but will probably reach a point within a few years beyond which it will decline very slowly if at all. The average type, soundness, and quality of colts produced must be improved if horses are to continue to compete successfully with mechanical power. The purchasing power of horses has been and is yet at a very low point. Judging from past experience, however, it cannot be long until the purchasing power of horses will start definitely upward and a period of increasing purchasing power, or value, should be experienced. It will pay the average farmer to begin now to raise colts, at least enough to replace his own work horses as they wear out.

Enterprise Survey for Horses and Mules

Owner or operator.................. P. O. Address......................

Location............................ Size of farm.............. Acres

Tillable..... Acres, Pasture..... Acres, Timber..... Acres, Waste..... Acres

CENSUS—HORSES

Name	Sex	Age	Wt.	Breed	Breeding	Registered

MULES

Name	Sex	Age	Wt.	Name	Sex	Age	Wt.

BARNS AND EQUIPMENT

Number..........Types.....................Single stalls............. Double stalls..........Box stalls..........Kind of floor..........How is manure removed................How often................Are hay and grain convenient............Kind of water tanks...................How is water pumped...........................Location of water with reference to barns.............................To pasture................. Other equipment...

BREEDING

Number of mares usually bred to jacks......To horses......How many colts do you raise a year............Are brood mares used for work............ How many horses do they replace..............How soon after the birth of the colt do you work the mare..............Age of colts at weaning.......

FEEDING

Feed per day per 1000 lbs. live weight (approximate amount)

Animal	Hay or Roughage		Grain	
	Kind	Amt.	Kind	Amt.
Mares				
Horses				
Colts				
Mules				

Kind of pasture used....................Quality...........How many months pastured...............Diseases during year.................. Preventions used................................Methods of control used..............................Losses.......................

DISPOSAL

Number sold per year........Ages........Total value........Where sold ....Do you breed for the market or do you intend only to maintain your workstock.........................

....

Is it cheaper to raise or to buy horses.................Mules............ Of what value are breeding and registration in making a sale.............. ....Does well bred stock make better work stock than grade stock.................Which do you prefer to work, horses or mules..........................Why.............................

Job 2. Understanding the Characteristics of Various Types and Breeds

Conditions Usually Found.—(1) There are too many "off-type" horses being offered on the market. (2) The relationship between form and function is not well understood. (3) The value of "breed type" is often overlooked.

Aims.—Students should understand the adaptations and advantages of the various types and breeds of horses and the different types of mules.

Problems for Study and Discussion.—(1) How did the various "types" of horses develop?

2. What are the chief distinguishing features between the draft and light horse types?
3. Why is weight of value in the draft type?
4. What is the explanation of the fact that long muscles are better adapted for speed than are short muscles?
5. Under what conditions may grade animals be more economical than those which are pure-bred?
6. What are the chief points of difference between the Percheron and the Belgian?
7. What accounts for the popularity of the Percheron in America?
8. In what way, historically, is the Thoroughbred of so much importance?
9. What is the real basis upon which "breed" is distinguished?

Activities.—(1) Specimens of the various types and breeds should be studied through visits to barns and farms. (2) Keep a record of the horses seen on streets or roads over a period of days, attempting to identify breeds and grades by the characteristics studied under this job. Determine which breeds are most popular.

Importance of Job.—It is important that the farmer, whether he is a producer or only a buyer of horses and mules, should be familiar with the outstanding features of the principal types and breeds. He should realize fully the relationship between form and function as expressed in type, and be able to recognize the outstanding characteristics of each breed. He will thus be enabled to select the breed which seems best to fit his needs and to develop such animals in line with the ideals of that breed.

Type and Function—Utility Classification.—Type may be said to be indicated by the general form of the animal and the purpose for which it is used. Thus the "draft-type" horse is of large size and blocky build, and is used in pulling heavy loads at a slow rate. The "light type," as the name indicates, carries less weight and is used for lighter work at greater speed. An intermediate type, in which many farm horses should be classified, may be called the "general-purpose type." Each of these types is subject to further sub-classifications with no distinct line of demarcation between them.

Draft Type.—Horses representative of the draft type possess the following characteristics: They are heavy, weighing from 1500 to 2400 pounds. The weight is accompanied by a low-set, deep, broad, and compact conformation. Large bones and heavy muscles provide the power by which enormous loads may be moved. A short, straight back, a deep, wide chest, and large feet always characterize draft type. The head should be of proper proportions, with wide nostrils and open throat-latch, joined neatly with the neck. The neck should be of medium length, powerful, well-arched, blending smoothly into the shoulders. The shoulders should slope in such a way that the weight of the load on the collar will be evenly distributed. The forelegs must be straight, powerful and well supported at the knee, and must show a medium slope of pastern. The barrel must be deep, long, and possess well sprung ribs. The region of the coupling should be short, strong, and heavily muscled. It is desirable that the croup be long and fairly level and continue the width throughout. The hind quarters should be deep, wide, and heavily muscled.

The draft-type animal is usually of a mild-tempered and quiet disposition, not easily excited. While considerable quality is desirable, its absence is less serious than in the case of the light type. The gait at which the draft horse works is most frequently the walk and it is desirable that it be characterized by speed, straightness, smoothness, and elasticity.

The Light-Horse Type.—This group includes a number of subtypes used for a variety of purposes. Its characteristics as a class are therefore less specific than with the draft type. In general, horses of this type are of light weight, from 850 to 1300 pounds. They are less compact in conformation (Fig. 88) than horses of the draft type, some representatives being rangy. Bones are smaller and muscles lighter and longer. The chest is deep but not wide in proportion to depth. A medium length of leg in proportion to body is desirable. The forearm is noticeably long in proportion to length of cannon, and the pasterns show considerable slope and springiness. Body lines are long but strong and graceful.

Rear quarters are long and deep, with hind legs more upstanding than is desired in the draft type.

Quality is an outstanding characteristic of the light-horse type. Fine, strong bone, loose, pliable skin, fine hair, and general refinement are typical. The temperament is active and frequently nervous. The way of going is always characterized by snap and springiness, and high action, speed, and variety of gait are stressed in the various sub-classes.

The Draft Breeds.—The Percheron and its grades outnumber any other draft breed in the United States. (Figs. 82 and 83.) It has proven popular both for city hauling and for farm work. The breed had its early development in France under the careful guidance of the government. While not the heaviest of the draft type, the breed carries sufficient weight for the work required. Colors are most commonly black or gray. The breed possesses qualities of refinement not characteristic of other draft breeds. In temperament and disposition the animals of the breed are usually satisfactory. The best Percherons have typical draft conformation, are upstanding in form without being leggy, are of good proportion, have feet of medium size and dense horn. The legs are free of "feather," or long hair on the lower leg.

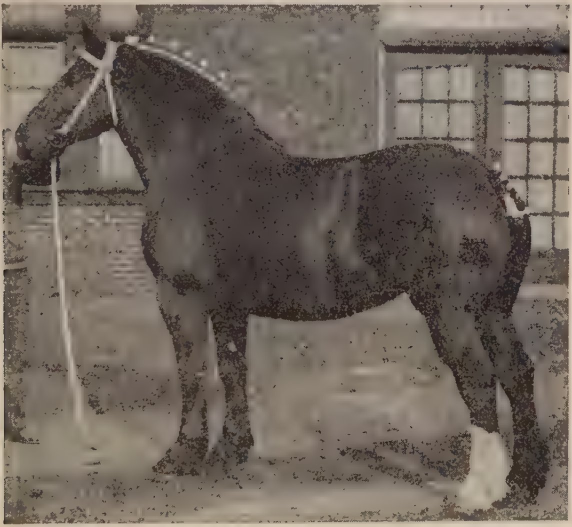


FIG. 82.—Margot, grand champion Percheron mare International Livestock Show, 1927. Owned by F. E. Murphy, Minneapolis, Minnesota.

The Belgian holds second place in point of numbers among the

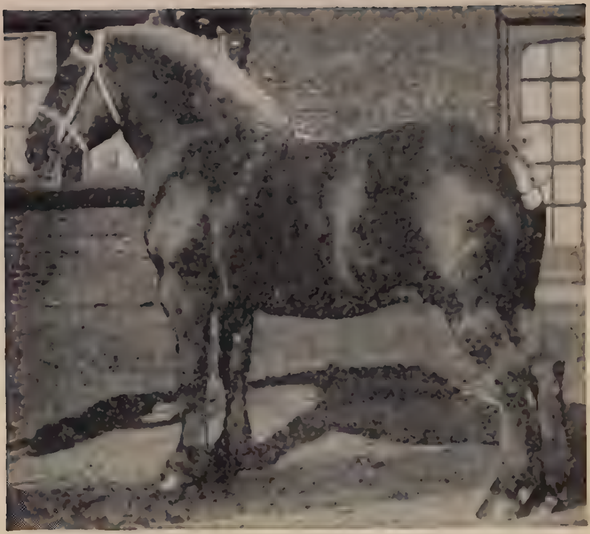


Fig. 83.—The low, wide, compact, massive form of the draft type. Don Degas, grand champion Percheron stallion, International Livestock Show, 1926 and 1927. Owned by G. A. Dix, Delaware, Ohio.

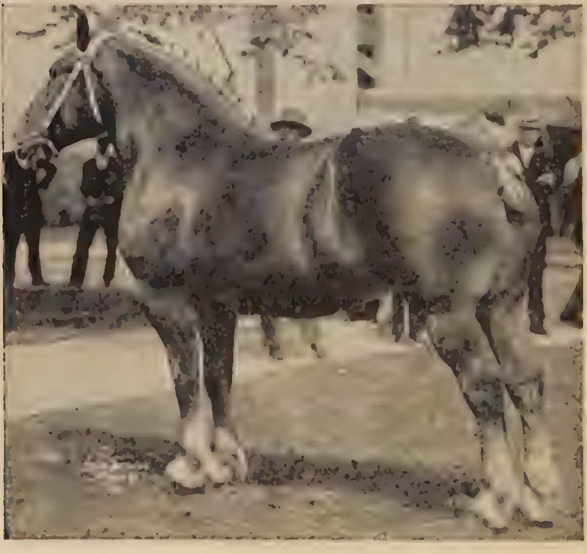


Fig. 84.—Maretta de Rubis, grand champion Belgian mare, International Livestock Show, 1927. Owned by the Michigan Agricultural College, East Lansing, Michigan.

draft breeds in America (Figs. 84 and 105). Developed with the aid of the Belgian government, it has probably descended from the old Flemish stock without the introduction of foreign blood. The American type of Belgian is an extremely stocky animal, broad both front and rear, deep, compact, and short-legged. Some representatives of the breed may be faulted for too small hoofs, coarse bone, and coarseness throughout. The breed as a whole has been much improved in these respects within the last twenty years. Solid colors predominate, with chestnut and roan leading, followed by bays and browns.

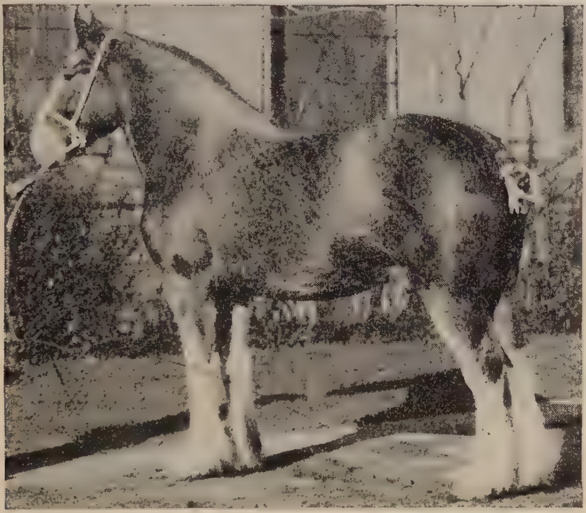


Fig. 85.—Lady Price, grand champion Clydesdale mare, International Livestock Show, 1927. Owned by the Experimental Farm, Indian Head, Saskatchewan, Canada. (Picture as a three-year-old.)

The Clydesdale, developed in the south of Scotland, has not proven especially popular in the United States in spite of its many good qualities. The breed is popular in Canada. (Figs. 85 and 86.) It undoubtedly shows the best action of any of the draft breeds, being straight, smooth, long, and snappy. Although in general the lightest of the draft breeds, it is still a heavy animal (1600–2300 pounds). Hocks, pasterns, and bone are excellent. The feet are well shaped and large. The "feathering" on the legs, the somewhat upstanding conformation, and the tendency to shallowness of body are features to which objection has been made. The colors most desired at the present time are bays and browns, although

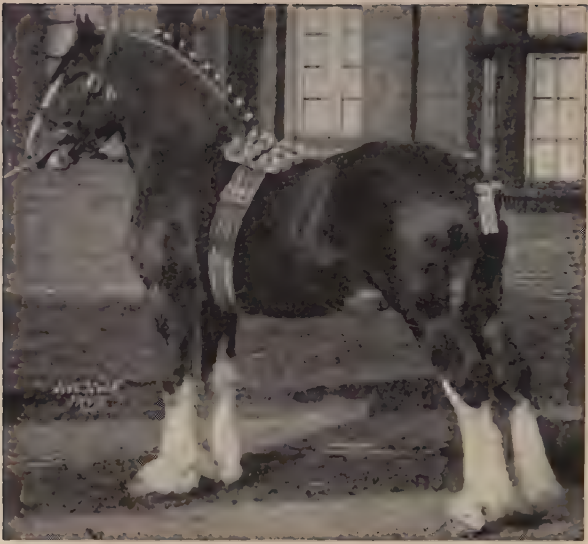


Fig. 86.—Sansovino, grand champion Clydesdale stallion, International Livestock Show, 1927. Owned by John Sinclair, Congress, Sask., Canada.

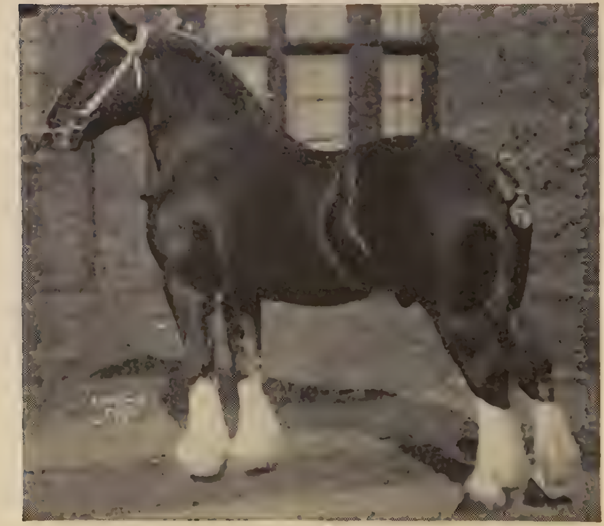


Fig. 87.—Bushnell Bohemian, grand champion Shire stallion, International Livestock Show, 1925, 1926, and 1927. Owned by Trumans' Pioneer Stud Farm, Bushnell, Illinois.

blacks, chestnuts, and roans with white marking are acceptable and widespread.

The Shire was developed in the rich lowlands of England and reflects this environment in his size, being the largest of the draft breeds. (Fig. 87.) Heavy bone and powerful muscling are outstanding characteristics. A tendency to coarseness and an extreme amount of feather have not been conducive to popularizing the Shire in America. The coloring is extremely variable, though white usually shows on legs and face.

The Light Breeds.—The Thoroughbred is a breed of English running horse developed primarily for racing purposes (Fig. 88). The breed originated as a result of crosses of oriental horses (Fig. 89) on native English mares. Its influence has been prominent in the early history of practically all light-horse breeds. In appearance the breed is characterized by muscular development, great chest depth, mechanically correct legs (Fig. 104), and extreme refinement throughout. Thoroughbreds stand about 15 to 16–1 "hands" (a hand being four inches), and weigh about 900 to 1250 pounds. Common colors are bay and chestnut, though white markings and other solid colors are found. The breed possesses an extremely nervous and energetic temperament.

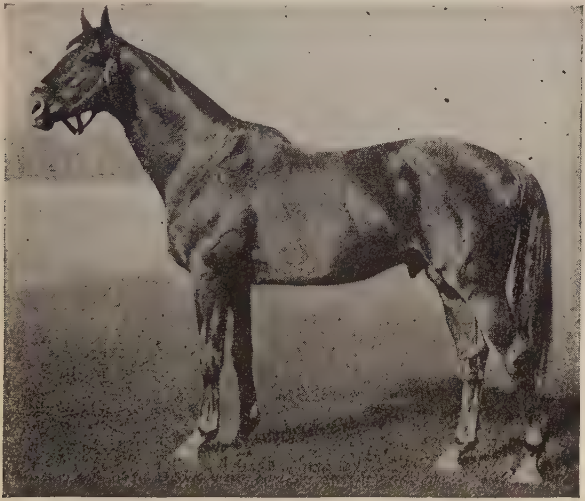


FIG. 88.—Man o' War, Thoroughbred stallion sired by Fair Play. Bred by August Belmont, owned by Samuel D. Riddle. (Photo by Sutcliffe. Courtesy Thoroughbred Record Co.)

The Coach Horse breeds include the Hackney (English), the French coach, and the German coach. Refined and clean cut in appear-

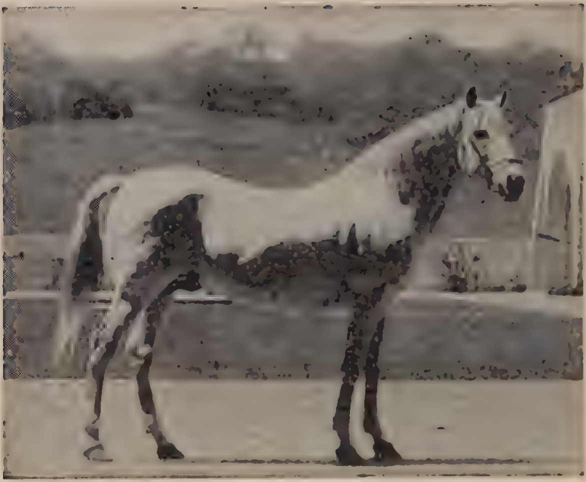


FIG. 89.—Letan, 17-year-old registered Arabian stallion. Owned by the W. K. Kellogg Arabian Horse Ranch, Pomona, California.

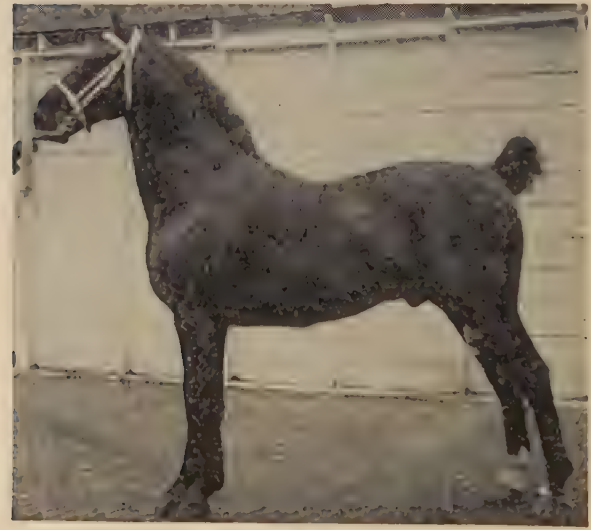


FIG. 90.—Minno, German coach stallion grand champion at the International Livestock Show, 1911

ance, and combining high snappy action with style, they make fine show horses and were formerly used extensively for drawing fancy park turnouts. Solid colors are desired, with white points frequently demanded.

The Hackney is the smallest of the group and possesses the trappiest action and a larger proportion of "hot" blood.

The German coach (Fig. 90) is the heaviest of the coach breeds and shows less spirit and action than the others.

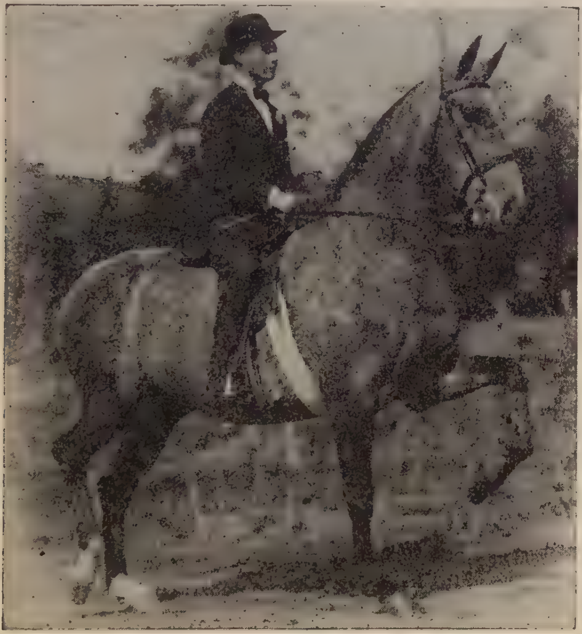


FIG. 91.—Tip Top, three-gaited saddle gelding owned by Carnation Farms. (Courtesy John T. Hook.)

The Standardbred may be regarded as the American road or driving horse. His working gait is the trot or pace. Thoroughbred and native American blood were fused in his development. The range in size is rather wide; 15–2 hands and 1150 pounds is a good average. Solid colors are desired with no particular preference except for the darker shades. Desirable qualities are medium size, refinement, well-knit conformation, good disposition, and a straight, road-consuming gait.

The American Saddle Horse.—Like the Standardbred, the saddle horse is the result of a Thoroughbred top cross on native mares. Kentucky, Missouri, and Tennessee have been the chief centers of development. His excellent quality and finish, smooth conformation, and highly intelligent appearance probably make him the most beautiful of horses. The feet and legs are well shaped and set, the back is short and straight, the croup is level and smooth, and the tail stylishly set on and carried. Solid colors are most prevalent and desirable. Saddle horses may be trained to either three or five gaits. In addition to the walk, trot, and canter of the three-gaited horse, the five-gaited horses may possess the running walk and the rack or single-foot. Many horses of saddle-horse accomplishments are used in harness and are then designated as "combination horses." (Figs. 91 and 92).

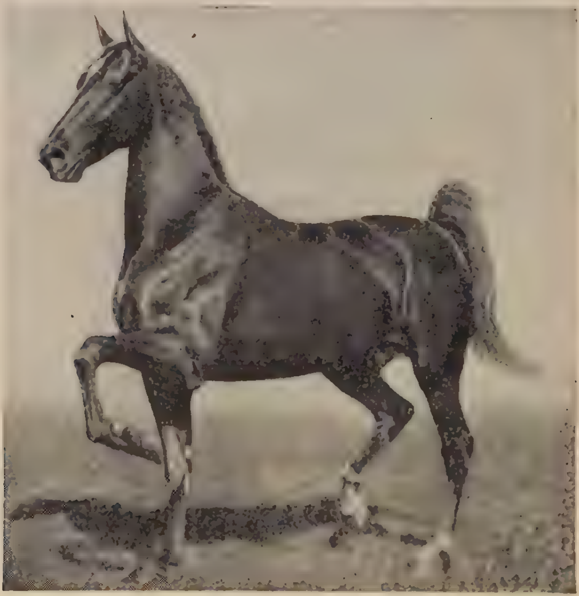


Fig. 92.—Chief of Long View, five-gaited saddle horse owned by Longview Farm, Lee's Summit, Missouri. Note the animation, action, soundness of hoofs, and the muscular development.

The Morgan may not, in the strict sense of the word, constitute a breed. The influence of the horse Justin Morgan, however, both in the development of the American Saddle breed and the Standardbred, has been of much importance. Interest in the Morgan (Fig. 93) has recently been revived by the U. S. Government and an attempt is being made to retain some, and improve upon others, of its original good qualities. It has possibilities as a combination, cavalry or light-work farm horse.

The Pony Breeds.—The ponies most commonly bred at the present time are the Shetland, Welsh, and Hackney. Shetlands (Fig. 94) are used almost entirely in America for the smaller children, while the Welsh are ridden or driven by older children. The larger *Welsh* are frequently used

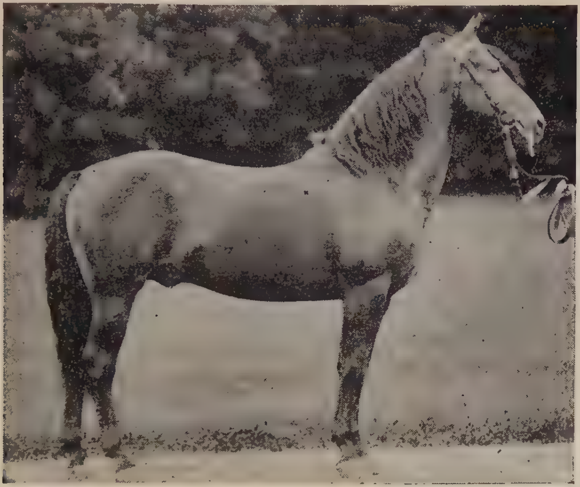


FIG. 93.—Troubadour, Morgan stallion. Owned by the U. S. Government Morgan Horse Farm, Middlebury, Vermont. (Courtesy of John Williams, U. S. D. A.)

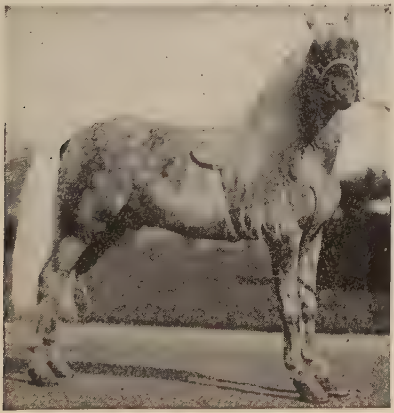


FIG. 94.—Silver Crescent, Shetland pony stallion, owned by the Weltz Pony Farm, Nevada, Iowa.

as ladies' driving horses. In type the *Shetland* is a miniature road horse, not as drafty as formerly. It must be of a gentle, reliable, and intelligent disposition. A maximum height of 46 inches is specified in the show ring. A wide range of color combinations is common. The *Welsh* pony (Fig. 95) is a miniature coach horse, with the same general conformation, style, and action. The height limit is 14–2 hands. Solid colors are most desirable. Hackney ponies are now considered a distinct breed. They have, however, all the characteristics of the Hackney except that the maximum height is 14–2 hands.

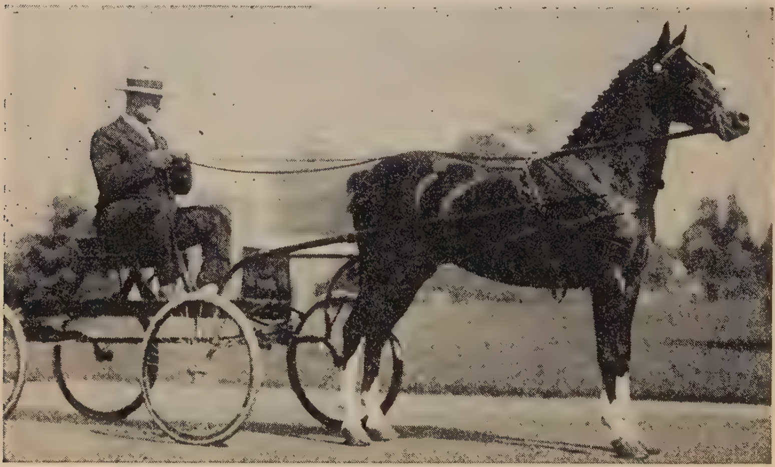


Fig. 95.—Baby Lou, Welsh mare. Owned by the Weltz Pony Farm, Nevada, Iowa.

The Polo Pony.—This is not a breed of horses. This class of pony varies considerably in size and characteristics. In general, however, it must be characterized by a good disposition, intelligence, and quality. The breeding is usually a mixture of Thoroughbred, western stock, and half-breds.

The Mule.—In the proper sense the mule is not a distinct "breed." Mules by their origin belong with animals known as "hybrids," which are the results of crosses between closely related species. The mule is the offspring of the mating between a mare and a jack, and in common with other hybrids is practically always sterile. The "hinny" is a product of mating a stallion with a jennet, but is not produced to an appreciable extent. In some characteristics mules differ considerably from horses, most noticeably in ears, feet, tail, voice, disposition, and ability to stand up under adverse conditions. Mules as a class are not uniform in size or color, these being influenced by the mares and jacks used in their production. Mules are popular for road and other construction work (Fig. 96) and supply the most of the animal power for farm work in the South.

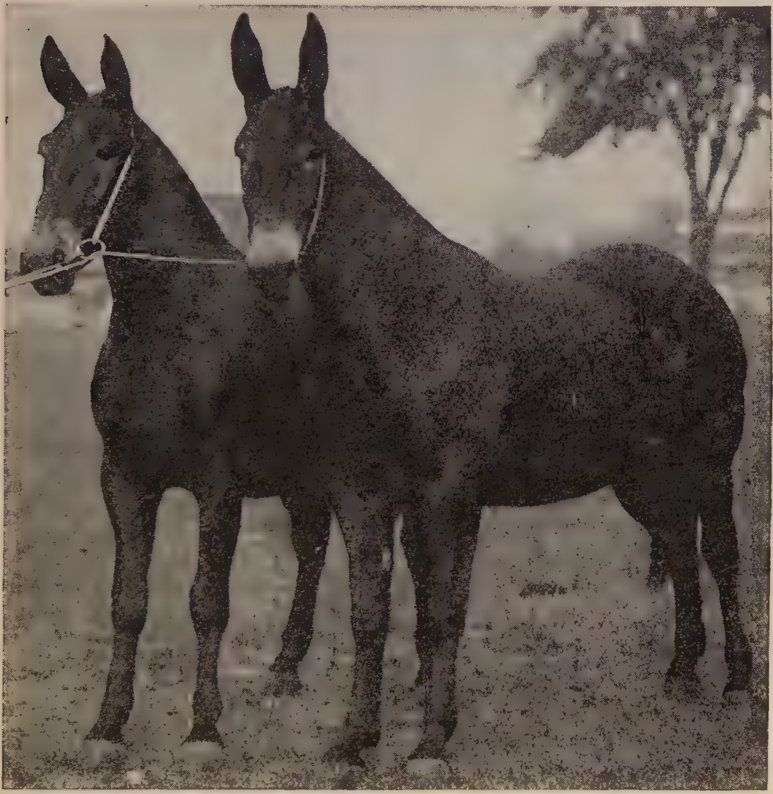


FIG. 96.—Draft mules usually bring the highest prices in the market. They should have good feet, heavy bone, and full ribs. [Smith, *Livestock Judging*.]

Job 3. Selecting Individuals

Conditions Usually Found.—(1) Either the individual or the pedigree may be over-emphasized in selecting workstock. (2) Unwarranted prejudices may influence selection. (3) The inefficiency due to unsoundness may be underestimated. (4) Dishonest dealers use many means of disguising defects and preventing the discovery of vices.

Aims.—(1) How to choose the best individuals should be thoroughly understood through study and practice. (2) How to detect unsoundness in animals should be learned through experience.

Problems for Study and Discussion.—(1) Why do horses within any one breed differ so in various characteristics?

2. Why should an animal's pedigree influence his selection as a breeder? As a worker?
3. What are the bases for the values assigned to the various characteristics of horses or mules as shown on the score card?
4. What are the most important factors to be considered in comparing draft animals? In comparing saddle horses?
5. What is the relationship between conformation and unsoundness?
6. What factors influence the estimation of age as shown by the teeth of horses and mules?
7. Why is a systematic plan most satisfactory in examining a work animal?

Activities.—(1) Score horses and mules until familiar with the relative values of the various points. (2) Practise comparative judgment. (3) Make an outline drawing showing the location of the various unsoundnesses. (4) Practise estimating weight and height. (5) Compete in comparative judging. (6) Compare various horses with respect to efficiency.

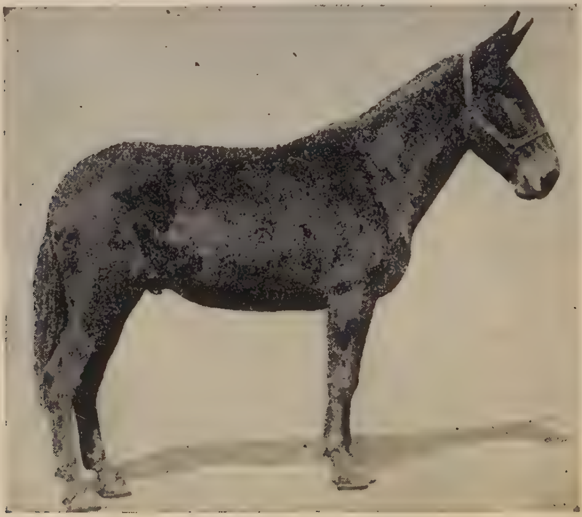


Fig. 97.—An excellent farm mule. (U. S. D. A.)

Importance of Job.—When a farmer has decided to produce or buy horses and has decided the type and breed with which he wishes to work, he still has the important job of making his selection of individual animals. Within any one breed, the animals will differ markedly in characteristics and thus in desirability. No two horses are exactly alike, some approaching the ideal more closely than others. A horseman must be able to recognize good and bad qualities, must be a keen observer, must understand how to examine an animal for unsoundness, and must have the ability to estimate age, height, and weight. In other words, it is extremely desirable to develop good judgment in the selection of horse stock. The breeder must select properly to secure desirable offspring and the general farmer to secure long and efficient service.

Work Stock vs. Breeding Stock.—In general characteristics such as conformation, quality, and temperament, there is little difference between breeding and work stock. (Fig. 97.) Such matters as age and pedigree, however, together with breeding ability and prepotency, must be considered when buying breeding stock. A sire or mare may be an excellent individual and entirely satisfactory as a work animal, but not suitable to use as a breeder due to unsatisfactory ancestry or other causes.

SCORE CARD FOR DRAFT TYPE

	Perfect Score
GENERAL APPEARANCE—24 per cent	
1. *Height*—Estimated ——; actual ——.	
2. *Weight*—Large, massive; must weigh 1600 pounds or over; ideal weight 2000 pounds or over, in good condition	10
3. *Form*—Deep, wide, drafty, "close-made," massive; strongly muscled; symmetrical; attractive lines, smoothly turned	6
4. *Quality*—Bone clean, hard, flat; tendons and joints clearly defined; fine, soft coat; refinement of features about the head and ear	5
5. *Carriage and Disposition*—Stylish carriage; spirited yet gentle disposition	3
HEAD AND NECK—9 per cent	
6. *Head*—Proportionate size, intelligent, clean, wide between the eyes, profile straight	2
7. *Ears*—Medium size, pointed, alertly carried	1
8. *Eyes*—Large, full, prominent, clear	2
9. *Lower Jaw*—Angle wide, strong, clean	1
10. *Muzzle*—Nostrils large, free from discharge, lips even, firm	1
11. *Neck*—Long, strong, slightly arched, throatlatch clean, carrying head high	2
FORE QUARTERS—20 per cent	
12. *Shoulders*—Deep, sloping, strong, snug; withers well back	3
13. *Arm*—Strongly muscled	1
14. *Forearm*—Broad, strongly muscled	2
15. *Knees*—Straight, broad, deep, clean-cut, well supported	1
16. *Cannons*—Bone of ample size; broad, short, flat, clean; tendons well back, sharply defined	2
17. *Fetlock*—Straight, broad, clean	1
18. *Pasterns*—Moderate length, sloping, strong, clean	2
19. *Feet*—Large, round, shapely; wide heels, clean hoof heads, straight walls, tough horn; sole, frog, and bars sound	5
20. *Set of Fore Legs*—Straight, squarely placed; viewed from in front, a perpendicular line from the point of the shoulder to the ground should bisect the knee, cannon, fetlock, and foot. Viewed from the side, a perpendicular line dropped from the center of the elbow joint should meet the ground at the center of the foot	3
BODY—12 per cent	
21. *Back*—Short, straight, broad, strong	3
22. *Loin or Coupling*—Short, broad, strong	3
23. *Ribs*—Deep, round, full, close; chest deep and wide	4
24. *Underline and Flanks*—Low	2

HIND QUARTERS—26 per cent

	Perfect Score
25. *Hips*—Broad, smooth, level	1
26. *Croup*—Fairly level, long, broad, full, muscular	3
27. *Tail*—Well set, stylishly carried	1
28. *Quarters or Thighs*—Deep, wide, full, powerfully muscled	3
29. *Gaskin*—Broad, strongly muscled	2
30. *Hocks*—Correctly set; broad, deep, flat, clean, hard	4
31. *Cannons*—Broad, short, flat, clean; tendons well back, sharply defined	2
32. *Fetlocks*—Straight, broad, clean	1
33. *Pasterns*—Moderate length, sloping, strong, clean	2
34. *Feet*—Large, round, shapely; wide heels, straight walls, tough horn; sole, frog, and bars sound	4
35. *Set of Hind Legs*—Correctly set; viewed from behind, a perpendicular line from the middle point of the buttock to the ground should bisect the hock, cannon, fetlock, and foot. Viewed from the side, when the cannon is perpendicular to the ground the back line of the cannon when extended should just touch the rear of the buttock	3

ACTION—9 per cent

36. *Walk*—Long, free, regular; straight, true; quick, springy	6
37. *Trot*—Straight, high, free, energetic, spirited	3
Total	100

SCORE CARD FOR LIGHT HARNESS TYPE

GENERAL APPEARANCE—12 per cent

	Perfect Score
1. *Height*—Estimated ——; actual ——.	
2. *Weight*.	
3. *Form*—Rangy, deep, lithe, angular	4
4. *Quality*—Bone clean, dense, fine, yet indicating substance; tendons and joints sharply defined, hide and hair fine, general refinement	4
5. *Temperament*—Nervous, active, disposition good, intelligent	4

HEAD AND NECK—7 per cent

6. *Head*—Size and dimensions in proportion; clear-cut features; straight face line; wide angle in lower jaw	1
7. *Muzzle*—Fine; nostrils large; lips thin; trim, even	1
8. *Eyes*—Prominent orbit; large, full, bright, clear, lid thin, even curvature	1
9. *Forehead*—Broad, full	1
10. *Ears*—Medium-sized, fine, pointed, set close, carried alert	1
11. *Neck*—Long, lean, crest well defined, extended carriage, well cut out in the throttle, head well set on	2

FORE QUARTERS—23 per cent

12. *Shoulders*—Long, oblique, smooth	2
13. *Arms*—Short, muscular, carried well forward	1
14. *Forearm*—Long, broad, muscular	2
15. *Knees*—Straight, wide, deep, strongly supported	2
16. *Cannons*—Short, broad, flat, tendons sharply defined, set well back	2
17. *Fetlocks*—Wide, tendons well back, straight, well supported	2

	Perfect Score
18. *Pasterns*—Long, oblique (45 degrees), smooth, strong	2
19. *Feet*—Large, round, uniform, straight, slope of wall parallel to slope of pastern, sole concave, bars strong, frog large, elastic; heels wide, full, one-third height of toe; horn dense, smooth, dark color	6
20. *Legs*—Direction viewed from in front, a perpendicular line dropped from the point of the shoulder should divide the leg and foot into two lateral halves. Viewed from the side, a perpendicular line dropped from the tuberosity of the scapula should pass through the center of the elbow joint and meet the ground at the center of the foot	4
BODY—11 per cent	
21. *Withers*—Well set up, narrow, extending well back	2
22. *Chest*—Medium width, deep	2
23. *Ribs*—Well sprung, long, close	2
24. *Back*—Short, straight, strong, broad	2
25. *Loins*—Short, broad, strongly coupled	2
26. *Flank*—Deep, full, long, low underline	1
HIND QUARTERS—31 per cent	
27. *Hips*—Broad, round, smooth	2
28. *Croup*—Long, level, smooth	2
29. *Tail*—Set high, well carried	1
30. *Thighs*—Full, muscular	2
31. *Stifles*—Broad, full, muscular	2
32. *Gaskins*—Broad, muscular	2
33. *Hocks*—Straight, wide, point prominent, deep clean-cut, smooth, well supported	6
34. *Cannons*—Short, broad, flat, tendons sharply defined, set well back	2
35. *Fetlocks*—Wide, tendons well back, straight, well supported	2
36. *Pasterns*—Long, oblique (50 degrees), smooth, strong	2
37. *Feet*—Large, round (slightly less than in front), uniform, straight, slope of wall parallel to slope of pastern, sole concave, bars strong, frog large and elastic, heels wide, full, one-third height of toe, horn dense, smooth, dark color	4
38. *Legs*—Direction viewed from the rear, a perpendicular line dropped from the point of the buttock should divide the leg and foot into lateral halves; viewed from the side, this same line should touch the point of the hock and meet the ground some little distance back of the heel. A perpendicular line dropped from the hip-joint should meet the ground near the center of the foot	4
WAY OF GOING—16 per cent	
39. *Walk*—Long, straight, free stride	6
40. *Trot*—Long, rapid, straight, reachy stride	10
Total	100

Judgment.—The development of judgment in regard to horses and mules may be brought about through study and experience, including constant and close observation. The first essential to be acquired is a clear conception of the ideal animal of the type with which one is concerned. Such a conception may be developed by critically studying the best animals available, particularly at shows and sales, where large numbers of excellent animals may frequently be found. The next best means of building up an ideal is to study good pictures of the winners at state and national shows. Such pictures will be found in the farm papers and livestock journals.

Another essential is familiarity with the names applied to the various parts and regions of the horse. This is important, for these terms are used in describing and discussing animals at sales and in the show ring. It would be difficult to describe an animal intelligently without knowing the "points." Figure 98 shows the names which are commonly given to the various parts of horses or mules.

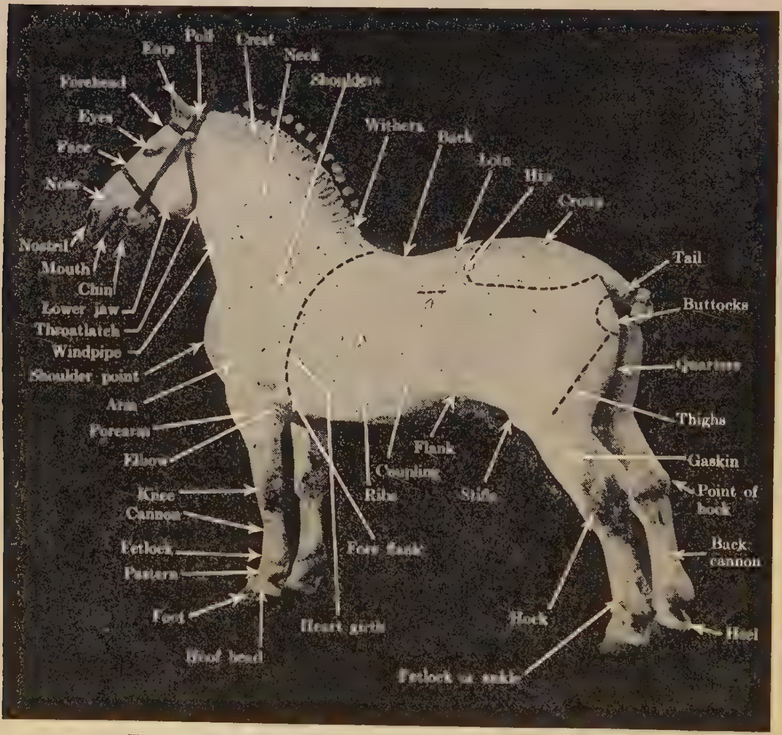


Fig. 98.—The points of the horse. (Smith, *Livestock Judging.*)

In becoming skilful as a judge, one of the most important abilities is that of understanding the relative values of the various parts of an animal as they affect its utility. For example, other things being equal, a horse lacking considerably in substance is less desirable than a horse slightly straight in pasterns. It is true, of course, that the judge must first be able to "see" that the first horse is light boned and that the other lacks sufficient slope of pastern. Such skill may only be acquired through careful and long-continued practice; in other words, the "judge's eye" must be developed. As there are many possible differences between two horses, and as a selection must frequently be made from among many, it is plain that the example cited above is much more simple than that which is met in practice.

The Score Card.—Probably the best method of becoming familiar with the relative values of the various parts is through the study and use of a good score card. This is a printed list, giving in outline form the principal items to be considered in judging how closely the animal being scored approaches the ideal. This list includes, in addition to conformation, such factors as weight, age, quality, temperament, and action. The ideal condition for each item is briefly stated and a score given to the item representing its weight in relation to a perfect score of 100 for the entire animal. (See score cards). The student is thus enabled to see what expert horsemen regard as the relative values of the various points of the horse. Practice in scoring will train the beginner in balancing strength against strength and weakness against weakness.

Comparative Judgment.—Scoring is but a beginning and should be only a practice step in learning to judge. The ability to make sound "comparative judgments" should be possessed by every farmer who uses work stock. This means that he should be able, after a brief but careful inspection, to select the best horse or mule from a bunch of ten or twelve or to pick from the group those animals which best meet his particular needs. The good judge rarely considers all the details of an animal but does pay attention to the more significant characteristics. He soon comes to recognize correlations in conformation too, i.e., straight shoulders and straight pasterns; coarse hoof texture and open texture of bones. Here again it should be said that *intelligent practice is the only road to accurate judgment.*

Judging Soundness.—In addition to conformation, the usefulness of horses and mules is governed by the condition of the animal relative to soundness. A "serviceably sound" animal is one free from any disease or deformity which would interfere with the satisfactory performance of the work which it would normally be expected to perform. Unsoundnesses are not equally objectionable, some interfering with usefulness more than others. Here also is a need for balancing one defect against another. Unsoundnesses of the feet and legs are usually the result of faulty conformation. It is well to bear this in mind when selecting horses, for although an unsoundness may not be evident, its appearance may be forecast from the unsatisfactory conformation of a part. Other unsoundnesses are due to mismanagement or accident, and the causes should be understood as a means of avoidance.

The Locations of Unsoundnesses.—Those most commonly found in horses are shown in figure 99. A brief description of some of these will be helpful in enabling the student to recognize them.

Blindness may be present and yet the horse's eyes may appear normal. Passing the hand quickly before the eye or causing the horse to be led over obstacles is a means of testing the sight.

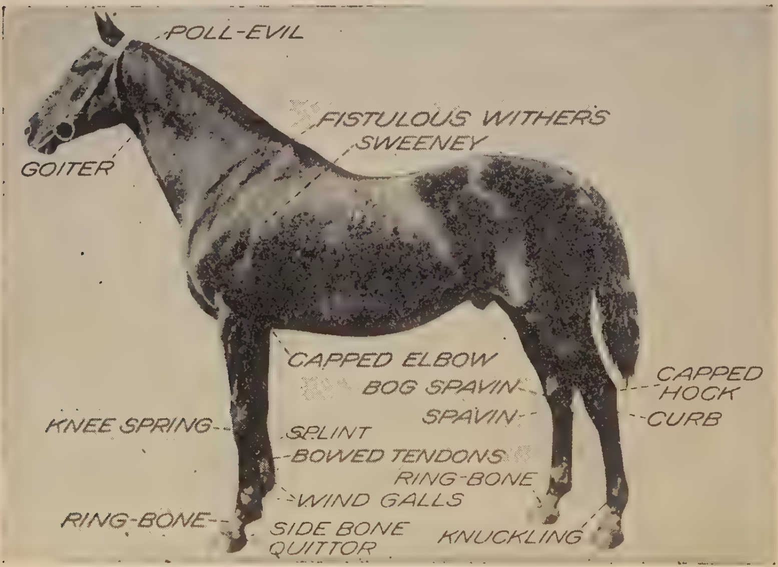


Fig. 99.—Location of points of unsoundness.

Poll evil is a disease usually caused by bruising the top of the head. Inflammation of the poll and a pus discharge frequently accompany the disease. It is difficult to cure and often leaves unsightly scars. Low doors and low stall ceilings should be avoided.

Fistula is a disease similar in nature to poll evil but located in the withers. It is difficult to heal and often becomes serious.

Splints are bony prominences found on the inside of the cannon just below the knee. They may cause lameness when close enough to the knee joint to interfere with its action.

Ring bone is an unsoundness of the pastern, caused by bony enlargements on the front and sides of that joint. It frequently stiffens the action. It may be detected by sight when large enough and earlier by feeling with the hand. It is usually associated with upright pasterns.

Side bones are bony formations on the sides and toward the rear of the coronet. As they become large they may cause stiffness and later lameness.

Thoroughpin is indicated by a swelling in the depression between the bone of the hock and the tendon running upward from the point of the hock. It is caused by a collection of fluid and may result in lameness.

Bog spavin is an enlargement in the depression on the inner front side of the hock. It is formed by a collection of synovial fluid which is soft to the touch. It may cause lameness.

Bone spavin, a bony enlargement, is located on the inside of the hock joint where the thick bony part tapers into the cannon. It is best detected by an examination from directly in the rear or front. Horses will usually limp when first starting out as a result of this unsoundness.

Curb is a fullness at the back of the hock below the point and may be best observed from the side. It is due to a thickening of the ligament and may become hardened and cause lameness.

String halt is a disease indicated by the extreme and jerky flexion of one or both of the hind legs in moving. It is unsightly and hinders action.

Heaves is a disease of the respiratory organs and is regarded as a serious unsoundness. The common symptoms are a double contraction of the flank with each expiration, expanded nostrils, and a short dry cough. The principal causes of the disease are affections of the lungs and faulty methods of feeding. Dusty hay and overfeeding should be avoided.

Vices.—Another important factor to consider in selecting stock for either breeding or work is that of vices or unsuitable temperament. Common stable vices to be avoided are halter pulling, cribbing, wind-sucking, kicking, weaving, and biting. Other vices are touchiness when bridling, saddling, or harnessing, not standing quietly, or not responding to the word of command. More serious vices which should usually cause the rejection of an animal are balking, backing, rearing, kicking, striking, or chronic running away.

Age in Horses.—Age is an important consideration in the selection of horses and mules. It has some bearing upon the price which will be asked for the animal as well as indicating his probable period of usefulness. The most serviceable age for horses is from six to twelve years, though prices on the market drop off after eight. Horses of excellent conformation may be expected to remain serviceable much longer than animals faulty in this respect.

Age in the horse is indicated in action and bodily changes, but is best estimated on the basis of changes in the teeth. Figure 100 shows the appearance of a horse's mouth at the various ages stated. The incisor

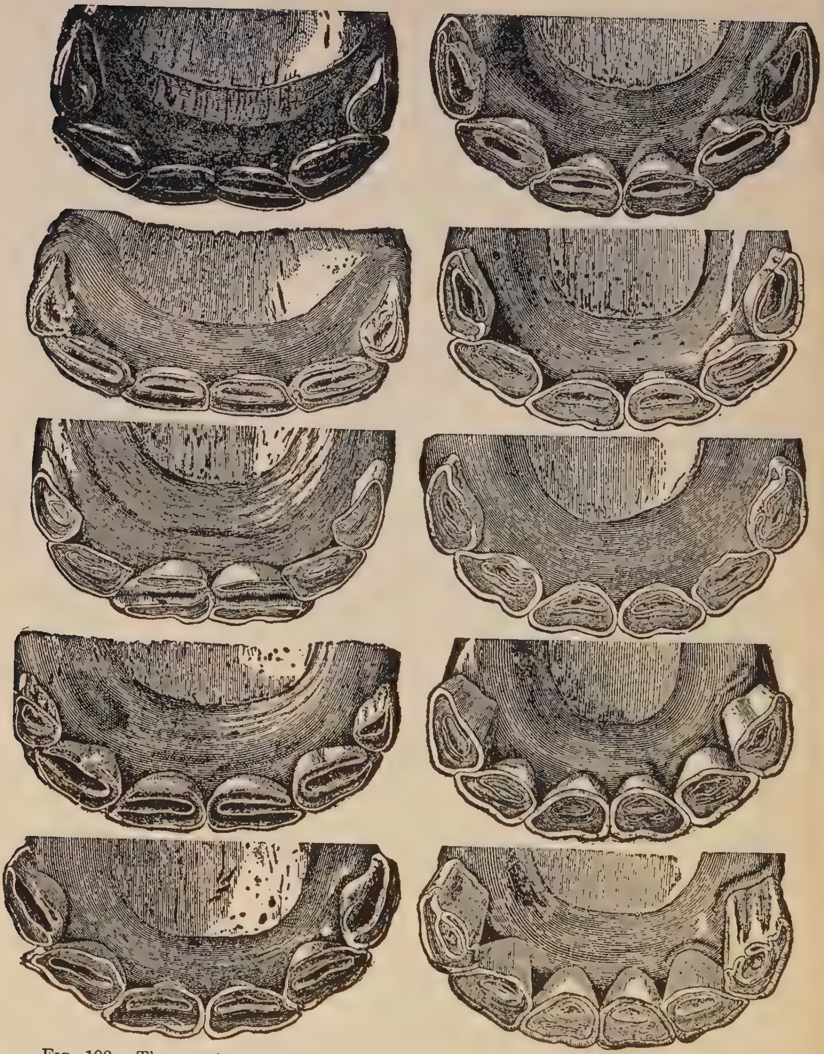


FIG. 100.—The wearing of the teeth indicates age. Beginning in the upper left hand corner and reading down, the views show the appearance of the lower teeth from the age of one to ten years. The first two center permanent teeth are up at 3, two more at 4, all up at 5. At six years, cups leveled on center teeth; at 7, cups leveled on intermediate teeth; at 8, all six are leveled and corners are becoming oval. More wear is shown at 9 and more at 10. Compare shapes and positions of central enamels. (Gay, *Productive Horse Husbandry.*)

teeth only are used as indications of age. The permanent incisors are distinguished from the milk teeth by greater size, no constriction at the base and a grooved surface. The incisors make their appearance in pairs, progressing in order from the nippers (center pair) to the intermediates (each side of nippers) and finally the corners (outside edge).

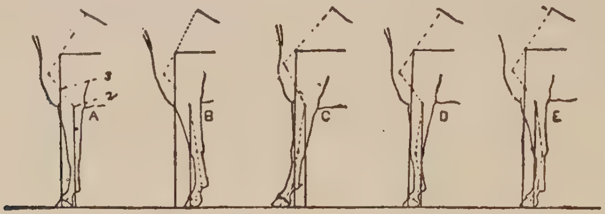
At birth the foal's mouth is usually toothless, but by two and one-half or three years of age all twelve of the temporary incisors are in and wearing. At about three years, permanent nippers have replaced the milk nippers; at four years the temporary intermediates have been pushed out; and at five the horse has a full mouth of permanent incisors (both above and below). Age is now indicated up until eight by the gradual wearing away of the grinding surface of the incisors. On this surface, the teeth show small brown spots which are called cups. As wear takes place, these gradually disappear, usually requiring three years for the process to be complete. Thus the cups are gone from the nippers at six, from the intermediates at seven, and from the corners at eight, leaving what is called a "smooth mouth" at this time. After this it is difficult to estimate the animal's age. The teeth show a change in shape on the wearing surface from oval to triangular, and in profile meet at a more and more acute angle with advancing age. In extreme age the visible part of the tooth has become longer because of the shrinkage of the gums.

One method of examining a horse's teeth is as follows: gently but firmly grasp the lower jaw in the right hand, pressing the thumb into the space between the incisors and molars (grinders); with the left hand spread the lips apart so as to gain a clear view of the teeth. Never stand in a position where there is a possibility of receiving an unexpected discharge due to coughing or sneezing, for there is danger of infection.

Height of horses and mules.—Height is measured from the top of the withers to the ground. It is usually given as so many "hands." It is seldom accurately measured, usually being estimated by placing the horse on a level and standing beside him. Knowing the height of one's chin or nose (in hands) and standing beside the horse, it is a simple matter closely to estimate the height at his withers.

Weight is more difficult to estimate but skill can be acquired through practice.

A Systematic Plan of Examination.—It is necessary in selecting horses or mules to be certain that all points are covered as rapidly as possible. Good judges follow a definite order in examining animals and find it helpful to them. The following procedure is recommended by men of long experience in selecting horses for various purposes. Have the horse standing on the level and in a good light. Examine him at a distance of twelve or fifteen feet, first from the front, then from the side, rear, and other side, and the angles between. In this inspection, particular attention is given to points of conformation such as depth and width of body, set of feet and legs, and general balance and symmetry (Figs. 101, 102, 103, 104). Substance and quality should be noted at this time, and a decision made as to the probable weight. In the clean-legged breeds it may not be necessary to handle the animal to discover unsoundnesses, but a close examination should be made. If necessary to estimate age and height, the horse may now be more closely approached. Suspicions as to unsoundness should be verified by handling if necessary.



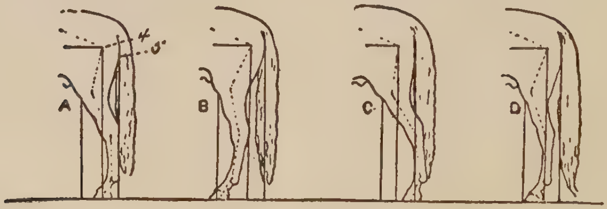


Fig. 101.—Correct and faulty direction of the fore legs when viewed from the side. A is the proper conformation. (U. S. D. A.)

Fig. 102.—Correct and faulty conformation of the hind legs when viewed from the side. A is desirable. (U. S. D. A.)

The horse should now be moved directly away from the examiner and then back, both at a walk and trot. Snap and straightness of action should be observed. Following this the action should be watched from the side with particular attention to length and smoothness of stride. In making comparisons among several horses, the beginner may take brief notes on the strong and weak points of each animal as a help in making his final decision. Note-taking should not be extensive or long-continued as it will prevent the development of the ability to "carry the animals in mind." The judge should pay little attention to the minor factors influencing selection unless it is necessary in a close decision.

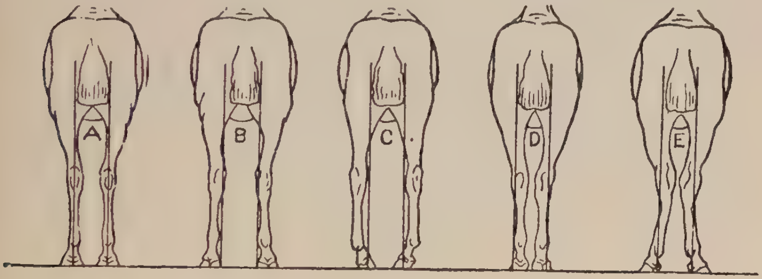
Job 4. Providing Barns for Horses and Mules

Conditions Usually Found.—(1) Barns are often poorly arranged. (2) Barns may be placed without regard to drainage, light, or protection from cold winds. (3) Floors may be in a dangerous and unsanitary condition.

Aims.—Suitable barns, economical construction, good locations and proper sizes should be studied carefully.

Problems for Study and Discussion.—(1) What are the advantages of a gambrel roof over a gable roof?

2. What factors should be considered in locating the horse barn?



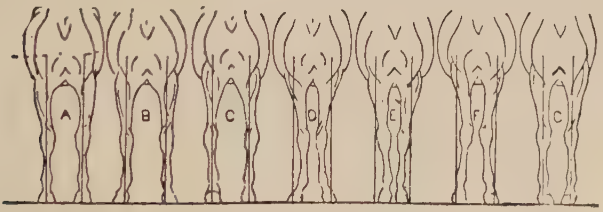


FIG. 103.—Desirable and undesirable positions of hind legs viewed from the rear. A is desirable. (U. S. D. A.)

FIG. 104.—Correct and incorrect conformation in fore legs as viewed from the front. A is correct. (U. S. D. A.)

3. How may dry and durable floors be provided economically?
4. How may satisfactory ventilation be secured in the barn?
5. In what ways may the double stall be divided?
6. How may the feed storage be arranged for convenience in filling and feeding?
7. What are proper sizes for stalls, doors, and windows?
8. What do horse barns cost in your community?

Activities.—(1) Visit some good barns of various types, noting features of construction and convenience. (2) Draw to scale a plan for the horse barn which would be most desirable for your farm. Carefully estimate the cost.

Importance of Job.—Although horses and mules are not regarded as delicate animals, and are frequently required to work under unfavorable weather conditions, it is necessary that they be fairly well protected from extremes of temperature, winds, and wet weather. It is important also that such shelters as are necessary shall be conveniently arranged and economical in cost.

Locating the Barn.—This includes several factors which need to be considered. The site should be within a reasonable distance of the house. It should be well drained, preferably a slight rise of ground. It should be so selected and the barn so constructed that the fields and other parts of the farmstead may be conveniently reached. The barn should be so placed that there will be no interference with light and circulation of air.

Barn Construction.—There is no distinct type of barn best suited for horses and mules. In some parts of the south, barns of open construction are used in order to secure plenty of ventilation; in the north, barns must be tightly constructed as a protection against cold, raw winds, and low temperatures. The gambrel roof is becoming popular because of the large loft capacity. Factors which should be considered in building or remodeling barns in which horses or mules are to be stabled are strength and durability of construction, economy of construction, proper size to accommodate the stock, storage space sufficient for hay and feed, and convenient interior arrangement.

The Interior.—The arrangement of the barn is so dependent upon various factors and individual requirements that it is not possible to discuss it completely in this book. Only general suggestions for guidance can be offered.

Floors may be made of packed earth, concrete, or wood plank. If clay is well packed and kept leveled, it is economical and satisfactory, both for stalls and runways. Rough-surface concrete is lasting and sanitary but it may be expensive, hard to stand upon, and cold for the horses to lie upon. Heavy plank floors are warm and comfortable for standing, and are not slippery; but they are neither durable nor sanitary, and at the present cost of lumber are nearly as expensive as concrete. Combinations of two or more of these materials may be used to advantage.

Alleys throughout the barn should be sufficiently wide for the purposes for which they are to be used. There is much danger from horses crowding or attempting to turn in too narrow a space.

Stalls are of two kinds, box and straight; the latter may be either double or single. Where several horses are maintained, at least one box or loose stall should be provided for use in sickness or for a mare at foaling time. This stall should be about twelve feet square. Straight single stalls should be about five feet wide by eight feet from manger to heel post for the large-size work animal.

Mangers and feed boxes should be stoutly built and of ample size. The manger should be open at the bottom to facilitate cleaning.

Feed bins should be of sufficient size, and conveniently placed for both filling with feed and feeding. Protection from rats and mice should be provided if possible.

Doorways should be wide and doors hung to slide, if possible, rather than hung on hinges. Windows should be of good size and number to provide proper light and ventilation. Place the windows above the height of the horses' heads, and hinged at the bottom, swinging in to facilitate ventilation. A convenient space for harness should be provided in order to prevent the rapid deterioration caused by its usual careless handling.

Cost.—The total cost of barns is dependent upon the size, materials and completeness of the structure. Large breeding establishments frequently expend many thousands of dollars for the stables. For the farmer, however, economy in buildings is desirable and a satisfactory barn for ten or twelve head of horses and mules can now be built in most parts of the country for $1500 to $3000.

Job 5. Raising the Colts

Conditions Usually Found.—(1) Mares are often bred without regard to their efficient use in farm work. (2) Mares in foal may be overworked or neglected. (3) Colts are carried along with no effort to supplement the dam's milk and start them on feed.

Aims.—The successful management of brood mares and their foals should be understood by young farmers.

Problems for Study and Discussion.—(1) What conditions govern the date at which the mare should be bred?

2. What should be the differences in the management for the mare in foal and the open mare?
3. How should the mare be fed just prior to parturition? Why?
4. Why is the colostrum so necessary to the well-being of the foal?
5. In what ways may "navel ill" be guarded against?
6. When and how should weaning be carried out?
7. From what troubles do colts die in your community?
8. How could such deaths be prevented?

Activities.—(1) Assist a young colt as soon after birth as possible by removing the membrane from the nose, and by aiding it to nurse. Note general condition, strength, and brightness. (2) Demonstrate the treatment of the umbilical cord and navel.

Importance of Job.—The first six months of a foal's life may be a critical period in influencing its future development. Even before the birth of the colt, the horseman must give the dam proper care in order to assure the best possible conditions for the offspring. Certain precautions are necessary at the time the colt is born, and digestive disorders must be guarded against. The colt must be kept growing right along, steadily and vigorously, and not be allowed to become stunted. (Fig. 105).

Time for Foaling.—The time of year at which a colt is foaled will depend somewhat upon the use of the mare. Although the natural season for the birth of colts is in the spring, the mare should usually be bred to drop the colt in the fall if she must be utilized extensively in the farm work. Spring colts have the advantage of pasture and consequent heavier milk flow in their dams, but have the disadvantages of heat and flies.

The gestation period for mares is about eleven months, though variation may be expected either way. In case the mare is to be re-bred, conception is usually more certain on the ninth day after foaling than on any other date. A mare will normally come in heat every 18 to 21 days and remain in such condition two to four days.

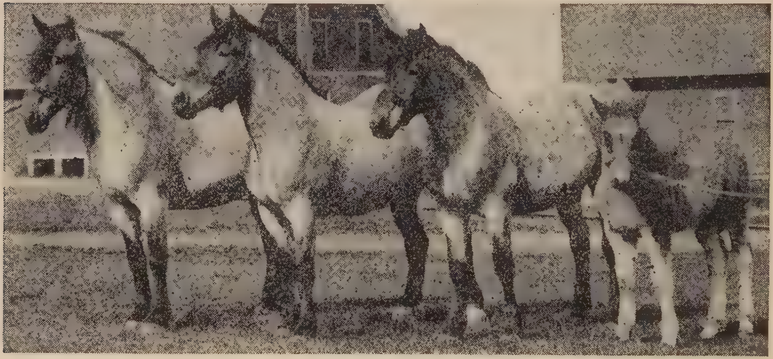


Fig. 105.—Jupiter's Venus, six-year-old Belgian mare, and her three colts. Owned by the Minnesota College of Agriculture. It is advisable for farmers in regions adapted to horse breeding to breed mares of good quality. The influence of the mare is indicated by the resemblance of the colts to their mother. (Warren and Pearson, *The Agricultural Situation*. Wiley.)

Care of the Mare.—In caring for the mare during pregnancy, plenty of exercise and a balanced and substantial ration are the particular requirements. Exercise in the form of regular work is most desirable, but must not be too strenuous, particularly as the time of parturition approaches. Work should be discontinued and the feed reduced about a week before the arrival of the colt, but the mare should have access to paddock or pasture where exercise is possible. The ration should contain a liberal supply of protein and mineral elements, particularly lime and phosphorus. Moldy or dusty feeds should not be used and the digestion should be kept active by the proper use of bran, linseed meal and succulence.

Foaling.—The birth of the colt can be foretold by the actions and appearance of the mare. She will become restless and nervous and wax will appear on the teats about a day before the colt is dropped. A clean and roomy box stall or a good grass pasture is probably the most satisfactory place for the mare at the time of parturition. The floors and walls of stalls should be thoroughly disinfected and plenty of clean, sweet straw provided. The mare should not be assisted unless it is absolutely necessary, and loud noises and quick movements should be avoided.

Two precautions are necessary in order to avoid serious trouble. As soon as possible after the breaking of the umbilical (navel) cord, it should be washed with a solution of boric acid or other mild disinfectant and then dusted freely with boric acid powder. This will prevent navel ill and other serious internal infections. The other necessary precaution is to be certain that the colt gets a plentiful supply of the fore-milk or colostrum from its mother shortly after birth. Nature has made this first milk exceptionally laxative in order that the intestinal accumulation may be voided at once. If the colt's bowels are not emptied within twenty-four hours, action must be stimulated by the use of a tablespoonful of castor oil or other purgative.

Keeping the colt healthy and growing is of great importance. A colt once stunted may never develop as could otherwise be expected. The foal should make half its growth during the first year. The flow of the dam's milk must be stimulated by a liberal ration of concentrates and succulent feeds where pasture is not available. The foal must be constantly watched for digestive disorders which may be caused by an overabundance of milk or milk too rich in fat.

If the colt can reach the feed box, he will begin nibbling with his mother at three to four weeks of age. This should be encouraged, and if possible some arrangement should be made whereby the colt may have exclusive access to feeds especially provided. A "creep" in pasture or even in the box stall will make this possible. Crushed oats or a mixture of this with bran, crushed corn and linseed meal is a good starting feed. Clean, sweet alfalfa or clover hay is excellent for colts and should be supplied to the extent that the colt will eat. Plenty of fresh, clean water should be available to the foal at frequent intervals. If the mares are working, the colts should not be permitted to run with them. It may be necessary to return the mares to the colts in the middle of the morning and afternoon, but the colts should not be permitted to nurse when the mares are over-warm.

Weaning is usually practised when the colt is five or six months old. It is not a difficult process if the colt has been encouraged in learning to eat and to get an ever-decreasing proportion of his sustenance from his mother. The separation once made should be complete, the foal and dam being permitted neither sound, sight, nor smell of one another. It may be necessary, in case of early weaning, to replace the dam's milk with skimmed cow's milk for a few weeks, but the colt will usually carry on with little difficulty. In the case of a heavy-milking mare, the udder may have to be milked out partially by hand for a day or two to avoid congestion and other troubles.

Job 6. Growing and Training Young Stock

Conditions Usually Found.—(1) Yearlings and two-year-olds are roughed through with insufficient feed and care, stunting their growth. (2) Breaking is a matter of force, resulting in broken-spirited animals or vicious temperaments. (3) Training is too long delayed.

Aims.—The problems of caring for and breaking of colts should be learned through study and practice.

Problems for Study and Discussion.—(1)How are colts fed from weaning to two years of age by local farmers?

2. What improvements in practice could be made?
3. What attention should be given the young animal's hoofs during this growth period?
4. What provision should be made for sufficient exercise?
5. Why should colts be supplied feeds which are rich in protein and minerals?
6. Why is it of advantage to start training the colt at an early age?
7. Under what circumstances should the young horse be punished?
8. What are satisfactory methods of punishment?
9. Why is the "team hitch" more satisfactory than breaking "single"?

Activities.—(1) Secure an opportunity to break young colts to lead to halter. (2) If possible, assist in training a colt to work in harness.

Importance of Job.—In order that the young animal shall grow into as useful a mature animal as possible, it is necessary that he be carefully fed and handled. The practice of allowing colts practically to shift for themselves is altogether too common. Bone and muscle-building feeds and proper shelter must be provided. The colt should be gradually gentled and trained rather than "broken" to the work which will be expected of him (Fig. 106). Too frequently a good horse or mule is ruined by lack of proper management during his colthood.

Feeding Grain.—Getting the colt on full feed is a comparatively easy matter if feeding has been well started before weaning. As the colt is adding to his body as well as maintaining it, feeds rich in protein, calcium, and phosphorus should be provided. Blue-grass pasture and oats make an excellent combination for the building of the bony framework and muscle tissue. Bran, linseed meal, and wheat middlings are good and give variety to the ration. Any of the legume hays, if free from dust or mold, are satisfactory and help to furnish calcium and protein. Corn may be fed if balanced with protein—rich feeds. The colt should be grain-fed at least once a day, even on good pasture, and always in sufficient quantity to maintain a vigorous growth. Overfeeding should be guarded against; it is often indicated by a sluggishness on the part of the colt. A healthy condition is shown in the animation of the animal, a smooth coat, and a clear eye.

Training the Animal.—This should begin early. The colt of two or three months should become accustomed to a halter and to the handling and presence of a human being. He should shortly be taught to lead at the halter and to remain quietly when tied. At all times in the process of training he should be treated gently but firmly and never punished unduly or without cause. He should be handled in such a way that he will gradually acquire confidence in his trainer. In training a colt to the halter, a light but stout and well-fitting halter should be used. Lead the colt first along an accustomed route, coaxing him to follow. Frequently a neck rope running through the halter ring will aid in training to lead and to stand tied. Always use equipment of more than usual strength, for the colt should never succeed in breaking away.

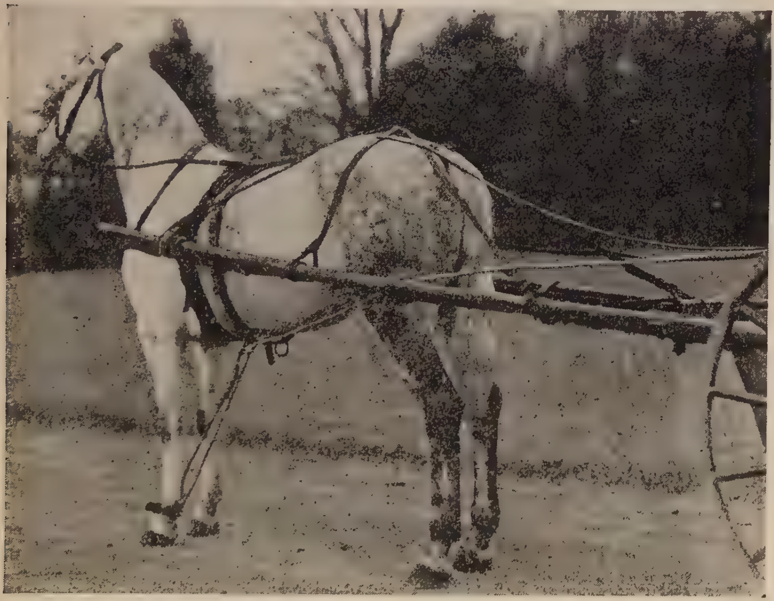


FIG. 106.—Training harness and attachments used in breaking colts. (U. S. D. A.)

The first step in training the colt for work (between two and three years old) is to put on the "bitting harness." This consists of a simple bridle, snaffle bit, check and side reins, with a surcingle and sometimes a crupper. This harness is placed on the colt and he is turned loose in a paddock for an hour or two. After this is repeated several times, lines are attached and the horse gradually trained, usually with someone leading for the first few times. As the lessons proceed, the colt should be taught the meaning of "whoa," "get-up," "back" and the pull of the reins to the right or left. The education process is slow, and more will be accomplished by the use of frequent short periods of training than by fewer long ones.

When the colt handles well in the bitting harness, add breeching and traces, tightening the harness as the horse gets used to it (Fig. 106). The colt is now ready to hitch to the wagon. This should usually be a team hitch, though with light horses intended for single driving, it may be best to use the breaking cart at once. The colt should be paired with a steady, well-trained older horse possessing a rapid walk. A stout stick (jockey stick) about four and one-half feet long, should be fastened at one end to the outer hame ring of the old horse and to the bit ring of the colt, preventing the colt crowding over.

The team should be driven a few times without the wagon, continuing the training in stopping, turning and backing. The horses or mules should then be hitched to the wagon and driven quietly, preferably in a big, level field. Gradually the driving periods may be lengthened and extended to the regular roads. An intelligent colt, intelligently handled, will soon learn and become an obedient, faithful, and valuable animal.

Job 7. Feeding Mature Horses and Mules

Conditions Usually Found.—(1) Too little thought is given to the feeding of work stock on many farms. (2) Feed and hay of poor quality are often regarded as "good enough" for horses and mules. (3) The amount of feed is not always regulated to the amount of work done. (4) Fresh water in sufficient amount is not provided by all farmers.

Aims.—Young horsemen should understand the best methods of feeding and watering horses and mules, whether idle or at work.

Problems for Study and Discussion.—(1) What are the principal feeds available locally for the horse and mule ration?

2. What is the most economical ration made up of such feeds for these animals (a) on pasture, (b) at light work, (c) at heavy work?
3. What is the average annual feed cost for horses and mules on farms of the community?
4. How does the horse compare with the cow in digestive apparatus?
5. What is the proper proportion between concentrates and roughages in the horse's ration?
6. Ask farmers whether or not the mule is an "easier keeper" than the horse.
7. What would be the ideal practices in watering work stock?

Figure balanced rations for animals of various sizes and ages at various kinds of work.

Figure costs of the above rations at current prices.

Figure the cost of pasture as a part of the horse and mule ration.

Activities.—Run comparative tests in feeding or study results of different feeds used on neighboring farms.

Importance of the Job.—The *Breeder's Gazette* gave figures showing the average annual cost of feed per 1000-pound animal as $75.66 for horses and $76.76 for mules. Although costs fluctuate from year to year, the feed cost for work stock is by far the largest single item to consider in the expense of maintenance. As a matter of economy, therefore, it is important to study the feeding problem. In addition to a saving in feed cost, it is desirable that horses and mules be so fed that health and maximum work efficiency will be maintained.

The Feed Requirements.—For horses and mules the feeding is practically the same. A 1200-pound mule at work on the plow for ten hours will require for the replacement of tissue and energy the same feed as would be required by a 1200-pound horse at the same work. Feed requirements for work stock are dependent upon the age, size, and condition of the animal, the character and quantity of the work, and the individuality of the animal. Young animals need rations of high protein and mineral content. Larger animals need more for maintenance. Thin animals require larger quantities of feed to build up the body. Animals at hard work must eat more to supply the needed energy. Some horses are "easy keepers," that is, they make good use of their feed, assimilating a larger proportion of the nutrients than does the average horse.

Horses and mules are producers, just as are beef cattle and swine—the product, however, is labor rather than meat. In the production of labor, nutrients must be supplied in the feed; these are usually grouped as proteins, carbohydrates, fats and mineral elements. Proteins are used largely in building and replacing tissue, and as an important constituent in blood, hair, hoofs, tendons, and bones. The carbohydrates and fats are fat formers, but furnish the energy necessary for body maintenance and work. Fats have a value 2¼ times greater than carbohydrates. The mineral or ash elements are important in all parts of the body, but especially in the formation of the skeleton, calcium and phosphate being particularly necessary.

Groups of Feeds.—Feeds for horses and mules may be grouped into three classes, concentrates, roughages, and succulence.

Concentrates are so named because a small quantity of the feed has a large nutritional value. Such feeds are particularly important in feeding horses because of their comparatively small stomachs. Grain and mill feeds are usually regarded as concentrates, those most commonly used being corn, oats, barley, wheat bran, wheat shorts, and linseed meal.

Roughages are cured hays and fodder which, while supplying some nutrients, have a large value in their bulkiness, keeping the stomach and intestines distended so that digestion and assimilation may be more thorough. The principal roughages used in feeding horses are timothy, mixed hays, clover, alfalfa, cereal hays, shredded corn fodder, and straw. These are of value about in the order named.

Succulent feeds have their chief value in adding palatability to the ration and in keeping the digestive system in tone. The chief succulent for horses is pasture; this is sometimes supplemented with soiling crops, roots, and ensilage.

Balanced Rations.—For horses rations are usually computed on the basis of the weight of the animal and the amount of work being done. The following table shows the requirements according to two accepted standards, the Wolff-Lehmann (German), and the Kellner-Armsby (American).

Feeding Standards for Horses Per 1000 Pounds Live Weight

	Wolff-Lehmann				Kellner-Armsby	
	Pounds Dry Matter	Digestible		N R	Digestible True Protein Pounds	Energy Values
		Protein	Carbo-hydrates and Fat (x 2¼)			
Light work	20	1.5	10.4	1.70	1.0	9.8
Medium work	24	2.0	12.4	1.52	1.4	12.4
Heavy work	26	2.5	15.1	1.60	2.0	16.0

Balanced rations should be figured for horses and mules just as for any other class of livestock. Using available feeds and digestion tables, a ration should be worked out which will closely approximate the standard. It must be remembered, however, that the "standard" is only one guide in making a satisfactory ration. The ration decided upon must not only supply the necessary nutrients in the proper proportion, but it should also be as economical as possible. It should be palatable and healthful, convenient to mix and handle, and readily stored without deterioration. The amount fed will vary not only with the weight and work of the horse but with his individuality as well.

Water.—Horses and mules will drink from 10 to 15 gallons of water a day, depending upon the work they are doing and the temperature. It is important that clean cool water should be supplied in sufficient quantities and at the proper time. In practice it seems to make little difference whether the water is given before or after the feed. It is important, however, that the horse be restrained from drinking too much when over-heated or when starting out on heavy labor. Watering frequently in small quantities is much better practice than allowing the horse to fill up at any one time.

Salt seems to be necessary to the health of horses and serves as an appetizer as well. It may be mixed with the feed at the rate of three-quarters of an ounce daily or kept available to the animals at all times.

Feeding Practices.—These vary widely among horsemen. It is most customary, however, to feed three times a day when horses are working. Often the feeding of grain at noon is omitted, especially with mules, and if plenty of high-grade hay is supplied, without apparent bad effects. Hay and grain are usually fed at the same time, most animals eating the grain before the roughage. The amount of roughage is usually limited only to the amount that will be readily cleaned up. Water is usually supplied when most convenient; frequently the mistake is made of not permitting a drink following the evening feeding.

Proper Feeding.—Feeding is an art as well as a science. Proper feeding is not a "rule of thumb" procedure and cannot be entirely learned from books. Horses must be studied in their reactions to the feeds given them and treated accordingly. The condition of the horse morning and night, his hair and skin, his hoofs, his eyes, the manure—all are indications which must be watched in order to conduct the feeding in the most satisfactory manner.

Job 8. Caring for Work Stock; Knowing Management Details

Conditions Usually Found.—(1) Farmers do not realize the necessity for attention to details. (2) The horse's efficiency is decreased because of poorly-fitted harnesses. (3) Conditions favorable to the development of vices are not remedied. (4) Harnesses wear out too rapidly because of lack of proper care.

Aims.—(1) Students should study the best methods of caring for horses and mules. (2) They should understand the best management under varying conditions.

Problems for Study and Discussion.—(1) Why and how should horses and mules be groomed?

2. What attention should be given to the animal's feet?
3. What are the most satisfactory practices in bedding work stock?
4. How should manure be handled and its value conserved?
5. What methods are satisfactory in tying animals in the stall?
6. What are the common horse and mule vices and their causes?
7. How may vices be prevented or cured?
8. What type of bridle, including bit, check-rein, etc., is satisfactory for draft horses? Saddle horses? Roadsters?
9. What type of collar is most satisfactory for farm work and how should it be fitted?
10. How should a set of harness be cared for in order that it will last a reasonable length of time?
11. What abilities should be possessed by the man who drives or works with horses and mules?

Activities.—(1) Participate in some grooming, harnessing, and driving contests. (2) Visit the local blacksmith shop to study methods of horse-shoeing. (3) Repair old harnesses brought in for this purpose. (4) Clean and oil harnesses. (5) Find an opportunity to fit horses with collars. (6) Adjust harnesses to fit different horses. (7) Clean, trim, and oil horses' hoofs.

Importance of Job.—It is frequently true that the success or failure of an enterprise may really depend upon the attention which is given to the details of management. There are many details which in themselves may appear to be of minor importance and yet which really have an appreciable effect upon the results achieved. Failure properly to groom or attend to the feet may result in disease or decreased usefulness; improper fitting of collars or harness may permanently injure the horse; lack of skill in driving or control of vices may develop habits which will materially lower the horses' market value. It is well worth while, therefore, for farmers to study and practise with a view to acquiring knowledge and skill in the details of horse and mule management.

Why Groom.—Grooming and other attentions given to the external body are of importance for at least two reasons, viz., improved appearance and better health. Removal of surplus hair, dirt, skin exudations, and stains with dull curry comb, stiff brush, and cloth is desirable. Grooming the animals after the day's work is most beneficial to the horses but frequently impracticable for the horseman. If possible, when the harness has been removed in the evening and the hair dried out, the dull curry comb should be run over the body against the hair. A stiff brushing should be given with the hair brush, and if time permits the brushing should be followed by a rubdown with a cloth. The comb should not be used on the head or below the knees or hocks. It is usually a good practice to sponge the horses' shoulders with salt water, especially early in the season. Clipping above the knees and fetlocks is desirable when mild weather is assured in the spring, but should not be practised in the fall unless special protection can be given the animals. Hair on the legs should be kept well brushed out and the region under the pastern should be kept especially clean to avoid "scratches."

Care of the Feet.—This is a vital matter so far as the usefulness of any class of horses is concerned (Fig. 107). They must be kept properly trimmed, when either shod or bare, in order that the weight of the body may be borne evenly and the action kept straight. The bars must not be trimmed out nor the frog allowed to become overgrown and ragged. The bottom of the foot should be frequently examined and cleaned out when necessary. If the hoof has a tendency to dry out and chip or crack, moisture should be provided. Neat's foot oil occasionally rubbed on the hoof prevents brittleness. Turning horses out at night helps to keep the feet in good condition. Horses should be shod by only the most capable blacksmiths and the shoes should be reset as they become loose or are outgrown by the hoof.

Liberal bedding for the animals when in the barn is an economical practice. The animals are more comfortable and rest better, they remain cleaner, and the manure is more readily handled. Year-old oat straw is probably the most satisfactory bedding under most circumstances because of its absorptive qualities and cheapness. Bedding should not be allowed to become foul; the unclean portion should be removed each morning, the remainder being thrown forward during the day.

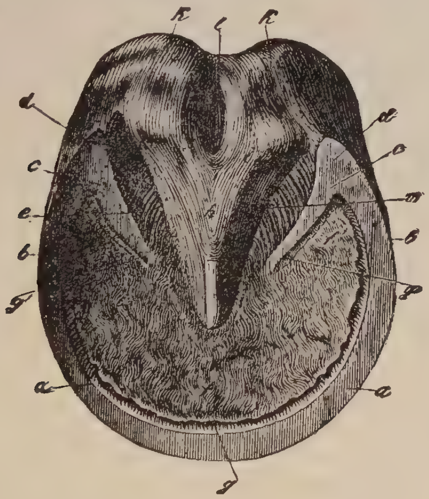


Fig. 107.—Plantar surface of right fore-hoof: *a*, *a*, bearing surface of the toe; *a*, *b*, bearing surface of the side walls or mammæ; *b*, *c*, bearing surface of the quarters; *d*, buttress, or angle formed by wall and bar; *e*, bar; *f*, sole; *f′*, branches of the sole; *g*, white line; it passes between the sole and bars and ends at *g′*; *h*, horny frog; *i*, branches of the frog; *k*, heels, bulbs, or glomes of the hoof; *l*, median lacuna of horny frog. Between the bars and the horny frog lie the lateral lacunæ of the frog. (Gay, *Productive Horse Husbandry*.)

Saving Manure.—The manure, removed from the stalls daily, should be handled in such a way as to conserve all the fertility possible. Placing it in large piles where burning and leaching may occur is wasteful. The modern stockman and farmer is finding the covered pit and the use of rock phosphate an economical practice in conserving the fertility of manure. The wheelbarrow and the track carrier are common means of conveying manure from the barn, the latter being more convenient.

Avoidable Accidents.—Carelessness in tying animals in the stall is often the cause of serious accident and loss. If the halter rope is tied up too short the horse cannot get his head in a comfortable position when lying down; if it is tied too long he may get his leg over it or become otherwise tangled. The tie rope, strap, or chain should be fastened to the manger at a length which will just permit the animal's head to lie flat on the stall floor. A device sometimes used is to pass the tie rope through a ring or hole in the manger, attaching a light weight to the end so that the tie is always kept taut.

Preventing Vices.—The control of vices should begin with prevention. The young horse or mule should be constantly watched to see that he is not acquiring bad habits which will develop into well established vices. If such habits have started, immediate steps should be taken to break them up. If allowed to become "set," such vices as balking, halter pulling, kicking, rearing, striking and running will be extremely difficult, if not impossible, to eradicate. Substitution is the principal control measure, i.e., give the horse plenty of exercise or work, feed a non-stimulating ration when idle, remove temptation toward vice establishment, and handle misbehavior with firmness.

The Harness.—The selection and fitting of harness calls for particular knowledge of the harness itself and the structure and performance of the horse. The basic parts of all harnesses are (1) bridle, (2) collar or breast strap, (3) saddle. These parts differ in strength, structure, and intricacy according to the purpose for which the horse is used. Each part has its accessories.

The Bridle.—The chief function of a bridle is to enable the driver to control the horse, largely through pressure on the mouth through lines and bit. There are many types of bits available for various purposes. The straight-bar snaffle is usually most desirable for work stock; several sorts of curbs are used, principally for saddle horses; and many special bits are used for various purposes. For work animals, the bridle should fit easily, the bit resting on the bars of the mouth without undue pressure. Bridles are either "open" or equipped with blinders, some animals doing better when allowed only a front view. Check reins are necessary for driving horses for both appearance and utility and may often be necessary with work horses both in city and country. The driving lines should be strong but as light as possible.

The Collar.—The breast strap or collar and accessories are the important parts of the harness from the standpoint of power. The breast strap is used almost exclusively for light driving harness, the traces being continuous with the broad band across the breast. The breast band should be adjusted so as not to interfere with either the wind pipe or leg muscles. The draft horse harness utilizes the full collar, usually made of hair-stuffed leather, to which hames and traces are attached. The fit of this collar is very important, for an ill-fit may result in sore shoulders, loss of flesh, or an evil-tempered animal. The collar should be fitted to each individual animal and factors such as immaturity and condition of flesh must be considered. With the collar fitting snugly against the shoulders, there should be room for the flat of the hand between the neck and the inside of the collar at the bottom and the tips of the fingers should slip in between the collar and the neck at the sides. The hames should fit snugly and be so adjusted and the traces so attached that the draft will be evenly distributed over the shoulder slope. Traces may be either leather or chain or part of each; they should be of equal length and attached to the hames at the same heights on the shoulders.

The Saddle of the Harness.—This is held in place by the belly band, the back strap, and crupper. In single harness, the thills are held by straps attached to the saddle; in double harness the traces are loosely held in place. Where a breech harness is used, the breeching is held up by straps running to the back strap. The breeching should be sufficiently heavy for the work to be done and fitted snugly but without binding. Harness should be selected with the idea of utility foremost in mind; the smaller the number of straps, buckles and ornaments the better, so long as the harness serves the purpose. The harness should be so adjusted that the horse will be comfortable and capable of making the best use of his strength. With a change of work it is frequently necessary to make adjustments in the harness to bring about these conditions.

Saving Harness.—The care of the harness is a much neglected job on the average farm. A few hours' attention would lengthen its usefulness by a great many days. The chief causes of deterioration in leather are excessive dryness, dampness, and dirt. Several times a year the harness should be thoroughly overhauled, repaired and cleaned. Repairing may be easily accomplished with a small amount of equipment consisting of waxed thread, awls, needles, punches, knives, and rivets. In cleaning, the harness should be soaked for twenty or thirty minutes in lukewarm water and washed thoroughly, using a castile or similar soap. Before the leather is dry, neat's-foot or prepared harness oil should be well rubbed in and the harness allowed to dry slowly. As a final step, all parts should be scrubbed with a heavy lather of harness soap and then dried with cloths. If possible, harness should be hung in a dry place, away from manure fumes. The bearing parts of collar, saddle, breeching, and traces should be frequently sponged to remove roughness due to a mixture of grease, dirt, and sweat. The collar should be carefully handled to avoid breaking.

Good Driving.—The handling of horses and mules in harness is one of the most important matters connected with their management. The driver must study his animals and learn to understand each individual. He must recognize signs of distress or pain, of fright, of balkiness, of viciousness, or of overwork. A horse or mule should never be punished without good cause and then only when the reason is clear to the animal. Horses and mules rate high in animal intelligence and resent abuse. Firmness, patience, and kindness are qualities most necessary in the successful handling of these animals.

Job 9. Maintaining the Health of Horses and Mules

Conditions Usually Found.—(1) Precautions are not always taken to prevent horses and mules becoming unsound. (2) Costs of production are increased because of preventable unsoundness, such as collar sores and lameness. (3) Work stock become sick through careless feeding and exposure. (4) Sanitation as a disease-preventive measure is not always practised. (5) It is not understood that the "tendency to unsoundness" is hereditary.

Aims.—How to prevent diseases and ills of horses and mules, and the best management when they are found, should be understood by beginners.

Problems for Study and Discussion.—(1) What sanitary measures should be practiced in preventing and controlling diseases?

2. What are the symptoms of the more common diseases affecting horses and mules?
3. What are the curative measures for the more common sicknesses: indigestion, distemper, colds, bloat, azoturia?
4. How should bruises be treated?
5. What care should be given cuts and wounds?
6. What should be done to relieve strains, pulled tendons, and similar injuries?
7. How should collar and harness sores be healed?
8. What are the means of control for external insect parasites of horses and mules?
9. How may infestation with internal worms be avoided and relieved?

Activities.—(1) Disinfect horse stables. (2) Practise drenching horses. (3) Dress bruises or other injuries on animals if the opportunity arises. (4) Assist in castrating colts. (5) Visit sick animals and study the symptoms. (6) Collect and place in a box first-aid medicines and materials.

Importance of Job.—The efficiency of work animals is very much dependent upon the maintenance of a normal, healthy condition. Sore shoulders, lameness, intestinal disorders, colds, parasites, all affect the animal in such a way as to reduce his usefulness, and in some cases result in death and consequent total loss. Persons responsible for the care of horses and mules must understand the predisposing factors of sickness or injury and act accordingly. An ability to recognize the symptoms of a disorder in the early stages is valuable. A knowledge of the curative measures for certain diseases will be of inestimable value.

Sanitation.—General sanitary and precautionary measures for the maintenance of the health of horses and mules are similar to those which are effective with other classes of stock. New animals should not be brought into contact with the farm stock until it is reasonably certain that they are free from infectious diseases. Horses should not be allowed to drink at public troughs; the feed used should be free from mould and dust; the barn should not be overheated or drafty; heavy drinking should not be permitted when the animals are overheated; stables should be kept clean and sweet by the removal of manure and the use of disinfectants; overfeeding should be avoided; plenty of exercise should be provided; the harness should be properly fitted; the animals should be sensibly loaded and driven at a reasonable speed.

Detecting Troubles.—The prevention and control of disease necessitates constant watchfulness and skill in the early recognition of abnormal conditions. It is frequently a fairly simple matter to cure an ailment if it is discovered in the early stages. Some of the most dangerous diseases affecting horses are contagious and it is important that the symptoms be recognized and the trouble diagnosed so that other animals may be protected through the isolation of the sick ones. Colds and abnormal conditions of the alimentary canal should be especially watched, for such disorders frequently develop into serious diseases. Sick horses should be kept quiet and provided a limited amount of palatable, slightly laxative feed and moderate exercise.

With some of the common and less serious ailments, the owner should be capable of effecting a cure. In all serious troubles however, the services of a well-trained veterinarian should be secured.

Indigestion is usually brought on by unsatisfactory feed or feeding practices, or by an accumulation of intestinal worms. The animal is nervous and shows signs of abdominal pain. In acute indigestion or colic, the pains are often intermittent and always severe. The course of the disease varies from a few hours to several days. A veterinarian should be secured promptly if possible, for quick action is necessary. The animal should be placed in a roomy stall and blanketed. The animal may be relieved by a drench of one pint of raw linseed oil and two ounces of turpentine. It may be necessary to reduce the pressure of gas by puncturing the intestinal wall with the trocar and cannula.

Colds are caused by draughts and exposure to wet weather, cold or changeable weather, or to irritations of the mucus membranes. Colds in themselves are not serious but may develop into catarrh or diseases of the respiratory organs such as bronchitis, influenza, congestion of the lungs, and pneumonia. Rest, a light diet of readily digested feeds, and dry comfortable quarters will usually bring about a cure.

Distemper or strangles is a communicable disease affecting largely the respiratory system of the animal. It is sometimes called colt-ill because of the fact that it is likely to affect immature animals. Symptoms consist of fever, discharges from the nostrils, usually a loss of appetite, unthrifty appearance, and a swelling underneath the lower jaw. Animals usually recover, there being only a 2 or 3 per cent mortality. One attack has a tendency to immunize against others. Treatment consists largely in rest, quiet, and a laxative ration. The animal should be guarded from exposure and, if the disease occurs during cold weather, blanketing should be practised. The swelling under the jaw should be lanced, drained, and washed with disinfectants, unless it breaks soon of its own accord. A horse in good vigor and health will usually throw off the disease within a week or so. In serious cases, a veterinarian should be called.

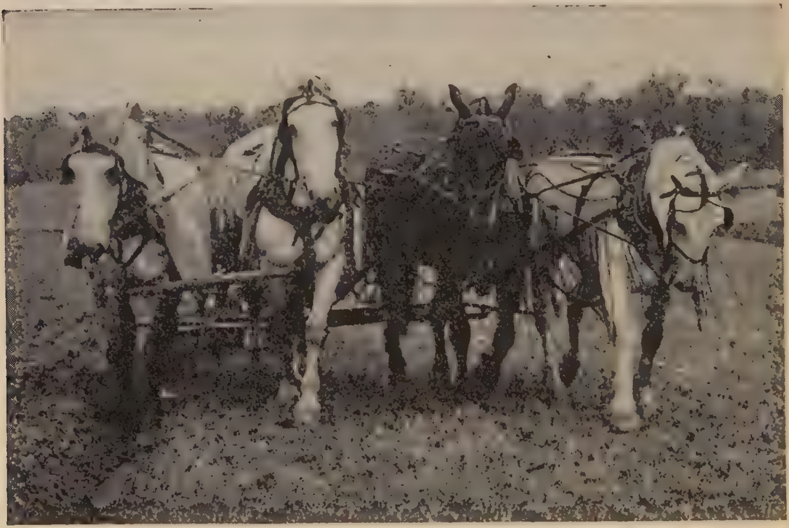


Fig. 108.—Four horses abreast on a 2-bottom, 28-inch gang plow Note the side draft and twisted positions the horses take. Crowding, overheating, and trampling at the turns are other evils of this hitch. (Courtesy of Horse Association of America.)

Azoturia is frequently a serious disease where horses are not worked steadily. It is caused by failure to reduce the ration during a period of idleness. The symptoms are noticed shortly after the horse starts work. Excessive sweating and rapid breathing, evidences of pain, and partial or total paralysis of the hind quarters are the progressive stages noticed. The animal should be stopped at once, the harness removed and the loins and hind quarters covered with blankets. If the horse has not gone down, he may be moved by easy stages to a stall. Complications such as permanent paralysis or atrophy of the muscles may occur. Preventive measures of course consist in reducing the ration during periods of idleness. Curative treatment consists merely of quiet, warmth, light laxative diet, and rest.

Bruises and Cuts.—The proper treatment of bruises, wire cuts, and strains is essential if work animals are to be kept in good working condition. Bruises are frequently more painful than they appear. They may usually be treated by frequent applications of heat and cold for several hours and the use of a small quantity of liniment. Tendon and muscle strains may be treated in the same way, but a more liberal use of liniment and rubbing is advisable. Bandages are frequently used in treating leg strains. In caring for wire cuts or other open wounds, the objective should be to promote complete healing. The wound should be thoroughly washed with warm water and an antiseptic solution. Ragged pieces of skin and flesh should be trimmed and stitches should be taken if the cuts are large. Where bandages are used, they should be carefully and frequently changed. Precautions must be taken to prevent the animal rubbing or nibbling the wound. Sprinkling boric-acid powder under the dressing helps in healing. Tincture of iodine and mercurochrome are often used as healing and antiseptic remedies.

Fig. 109.—Same plow and horses as shown in figure 108. In the tandem hitch there is no side draft and all horses are working in comfort.

Parasites.—Common insect parasites of horses are bot-flies, lice, and mites. During warm weather the female bot-fly lays yellowish eggs upon the hair, usually on the legs. The larvae, which hatch out in

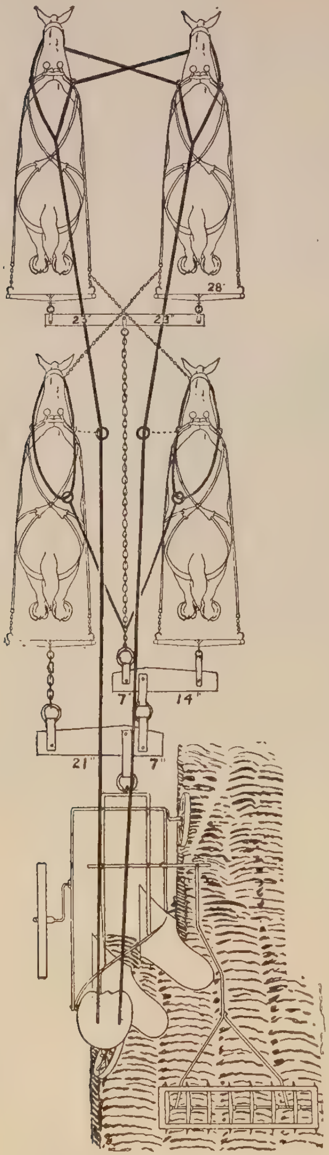


FIG. 110.—The 4-horse hitch recommended by the Horse Association of America. Illustrates the "tying-in" and "bucking-back" system. Compare with figure 108.

three or four weeks, reach the mouth or the tongue and then pass into the stomach. They attach themselves to the stomach wall and remain until fully developed, passing out with the excrement and going through the pupal stage in the ground. Symptoms of infection are not always clear, but animals may appear unthrifty and "pot-bellied" and show signs of indigestion. Treatment is largely preventive. The eggs may be removed by clipping the hair, or by scraping with a knife; they may be destroyed by using a three per cent water solution of carbolic acid. Such treatment should be given every two weeks during the season.

Lice.—Both sucking and biting lice may affect horses and mules. Symptoms are dirty, rough coats, rubbing, biting, and restlessness. If the infection is serious, the stables should be thoroughly cleaned and disinfected and the animals washed in a two per cent solution of cresol or other coal-tar disinfectant.

Mange in horses and mules is caused by several species of mites. Symptoms are intense itching, inflamed areas, unthrifty condition, the breaking and loss of hair. This trouble is frequently very difficult to cure. Washing with a two per cent cresol dip is recommended. Sulfur iodide ointment may be helpful and may be used in the early stages on the small affected areas. Treatments should be repeated in ten or twelve days. Mange is particularly serious because of the ease with which it may spread from one animal to another. Stables and harness should be thoroughly cleaned.

Worms.—Several species of stomach and intestinal worms are sometimes the cause of serious difficulties. If present in large numbers, these parasites may cause pain, depraved appetite, diarrhœa or constipation, and general unthriftiness. Such symptoms are usually unaccompanied by fever. Diagnosis is made certain by the discovery of the worms in the manure. Preventive treatment consists in changing pasture, avoidance of moist pasture, and maintaining vigor through liberal feeding. If the worms are present in sufficient numbers to require medicinal treatment, a competent veterinarian should be called.

Job 10. Using Work Stock Most Efficiently

Conditions Usually Found.—(1) Horses and mules are commonly worked only a small proportion of the time. (2) Multiple hitches are not so commonly used as they might be. (3) Mares are too often not bred. (4) Cost records are not often kept.

Aims.—Good management to make the most efficient use of work stock is necessary to success where horses and mules are raised and used.

Problems for Study and Discussion.—(1) How many hours of horse labor are used on the average farm of the community?

2. What is the relationship between hours of man-labor and of horse-labor on several typical farms in the locality?
3. In what ways may horse-labor be utilized to advantage throughout the year?
4. Under proper management, what should be the relationship between acres and horses on the farms of the community?
5. What factors will govern the size of the horse or mule which will be most efficient in farm work?
6. How are horses "hooked up" in multiple hitches of various sizes? (Figs. 108, 109, 110).
7. How should brood mares be handled for most efficient use?
8. What is the value of keeping records on horses and mules?
9. What records should be kept and in what way?

Activities.—(1) Construct eveners for various hitches. (2) Make special harness parts for multiple hitches. (3) Practice hooking up and driving 3-, 4-, 5-, and 6-horse teams. (4) Draw suitable forms and keep horse and mule records at home. Include feed record, record of labor performed, miscellaneous costs.

Importance of Job.—It has been carefully estimated that a horse utilizes annually 25.3 bushels of corn, 37.8 bushels of oats, 1.7 tons of hay, and 1.96 acres of pasture, or the production of 4 acres of fertile land. The larger part of this material will be consumed whether the horse works or not. Interest on the money invested, cost of shelter and care, taxes and other expenses, must be charged to the animal whether it works or is idle. It is most important, therefore, that the man who uses horses or mules should use them in the most efficient manner in order that they may return a profit.

Labor Needed.—The amount of horse labor which may be efficiently used on the farm varies greatly with conditions. The size of the farm and the character of the farming are the two principal factors in deciding the amount and character of horse labor needed. Under most circumstances, the smaller the farm, the less horse labor is required. The smaller the area of cultivated crops, the fewer are the mules or horses needed. According to data of the U. S. Department of Agriculture, (1921) for corn-belt farms of about 200 crop acres, an average of nine horses per farm was required to handle the work. From the viewpoint of economy in managing horse labor, experience on the farms studied by the Missouri Station (Bul. 152) seems to warrant keeping sufficient work stock on a general farm of this region so that each horse will not have more than an average of 1400 to 1500 hours of work annually, but it will not warrant a large enough supply to make the average amount of labor per horse less than 800 hours.

Keeping Horses Busy.—The distribution of horse labor throughout the year will of course influence the cost per hour of work as well as the number of horses which must be kept. Data secured in the corn belt showed that a horse which worked 643 hours a year cost 60 per cent more per hour than another horse working 1,286 hours. The following discussion is taken from U. S. Farmers' Bulletin 1298:

> "The most profitable combination of enterprises may require a large number of horses for only a short period of the year, even though many of the horses are idle during the greater part of the time. The average hours worked per day or per year under such conditions may be exceptionally low and still it may be the best of management to continue such a form of organization. Even on the same farm there will be a certain amount of variation in the days of horse work required from year to year, owing to changes in the acreages of the various crops, amounts of livestock kept, conditions of weather and soil, crop yield, etc. However, when comparisons are confined to farms within a region like the corn belt, where farming practices are much the same, the hours worked per horse and the cost per hour of work are of value as indications of the degree of efficiency with which horses are employed. Such comparisons usually show that a part of the farmers in a locality are using their horses more economically than others.
>
> "On horse-operated farms the average number of acres of crops tended per horse in different sections of the corn belt varies from about 18 to 24. On individual farms within a given locality the variation is even greater. A low number of crop-acres per horse is usually associated with a relatively high cost per acre for the work done, and often indicates that the farm is overstocked with work horses. The keeping of more work stock than is necessary properly to perform the work is almost sure to result in a relatively high cost per acre for power."

Management Factors.—The securing of maximum returns from the work of horses and mules is dependent upon many frequently-overlooked factors of management. Each farmer should work out the details to fit his own conditions. Horses of proper size and weight for the character of the work should be selected. It is just as inefficient to underload a horse as to overload him. The use of multiple hitches, with larger implements and more horse power per man, is an important means of lowering costs. The use of easy draft implements and plenty of oil on the friction surfaces will enable the horses to do more work in a given time. The proper fitting of harness, particularly of the traces, will enable the animal to use his power to the best advantage. In using multiple hitches, it is usually best to select the type requiring the fewest horses abreast and so arranged that all have firm footing. Equalization of draft and ease of control are important factors in multiple hitches.

The Use of Brood Mares.—The keeping of brood mares is coming to be recognized as an efficient means of meeting the seasonal labor need which will probably continue common on most farms. By properly regulating the breeding, the mares can be worked during the busy season as supplemental horse power, especially for the lighter jobs. The balance of the year, the mare more than pays her upkeep by the development of the foal.

Record Keeping.—This is a much neglected practice on the average farm. The charge of unbusinesslike methods frequently brought against the farmer is to a certain extent supported by his failure to "keep books" on his enterprises. The cost of work stock is usually the largest item next to that of man labor, amounting on the average to nearly 20 per cent of the cost of producing all farm crops. In spite of this, work-stock

Monthly Record of Labor of Work Stock

DATE	NELL		DOLLY		MARY		JENNY		PRINCE	
	Hrs.	Enterprise	Hrs.	Enterprise	Hrs.	Enterprise	Hrs.	Enterprise	Hrs.	Enterprise
1......										
2......										
3......										
4......										
5......										
6......										
7......										
8......										
9......										
10......										
31......										
Total...										
% Idle..										

records are seldom kept. The purpose in keeping records on horses and mules is primarily to determine the cost of the work done. The actual labor record is chargeable to the enterprise upon which the work is done, but the cost of this labor should be figured on the basis of the upkeep charges against the horse. The record of such charges should include cost of feed, chores, harness, bedding, stabling, shoeing, veterinary service, taxes, insurance, and interest on the investment. Animals should be credited with the manure produced, colts raised, and labor performed. (See record forms in beef enterprise.)

Records of work of each work animal may be kept. This gives a basis for calculating a true balance for the farm regarding the number of work animals which should be kept next year. The form on page 217 may be used each month and the total labor of each animal is easily calculated for the year.

Job 11. Improving Horses and Mules

Conditions Usually Found.—(1) Any stallion that will get a mare in foal is regarded as "good enough." (2) Surplus work stock in the community is not uniform in character. (3) The influence of heredity is not recognized.

Aims.—The laws of breeding and how to apply them in the horse and mule enterprise should be studied.

Problems for Study and Discussion.—(1) What is the influence of heredity in horse and mule breeding?

2. What part does environment have in improving work stock?
3. What are the outstanding considerations in selecting the stallion or jack?
4. What is the real value of prepotency?
5. How may the breeder make use of the laws of "variation" and "heredity"?
6. How may coöperative improvement be carried on?

Activities.—(1) Bring together the get of a good sire, or progeny of a good mare for comparison and for proof of the value of such a sire or mare. (2) Collect the pedigrees of well-known horses for study and comparison. (3) Judge some animals primarily from the breeding standpoint, considering both individuality and ancestry.

Importance of Job.—The competition of the tractor and truck has made the improvement of work stock more necessary than ever before. More is expected of animals and only those which most nearly meet such expectations will be profitable to their owners. While the relative number of horses used for farm work may eventually be diminished, the demands for quality will constantly increase.

Breeding.—The laws of breeding for horses are no different than for other classes of animals. Heredity, environment, and selection are the most important means by which horses and mules may be improved.

Heredity refers to the influence of the parents, grand-parents, and other ancestors. The closer the relationship, under usual conditions, the greater will be the influence. It is therefore important that animals used for breeding shall have an ancestry made up of animals having desirable characteristics.

Environment is the term applied to all that affects an animal after its birth. Feed, shelter, training, climate, and management are factors in environment of much influence in determining the character of the adult animal into which a colt may grow. Unless the environment is properly controlled, all the value of good breeding may be lost.

Selection as a factor in improvement has to do with the retention of the best animals for breeding purposes. "Natural selection" is that carried on by nature in causing the unfit to die off. "Artificial selection" is the selection by man of the animals possessing the qualities which best meet his needs. Man selects on the basis of pedigree (ancestry) and individuality.

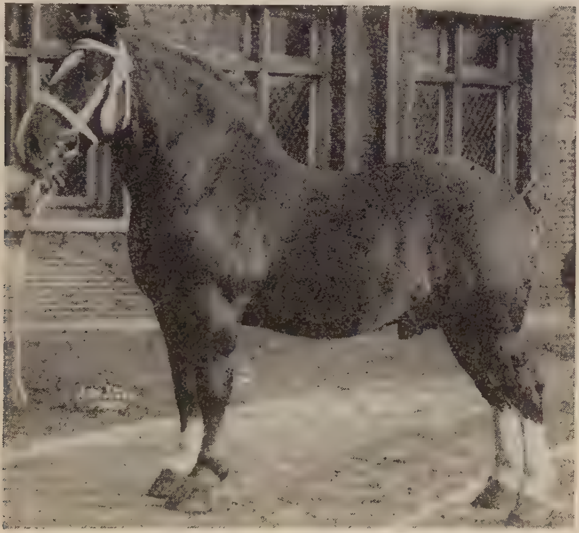


Fig. 111.—Waynesdale King, grand champion Belgian stallion International Livestock Show. Owned by Evert King, Chicago, Ill.

It is important that both sire and dam be as nearly the desired standard as possible. Each will have, on the average, equal influence on the character of the progeny. It is a mistake to expect to produce a superior colt from an inferior mare, even by the use of a fine sire. In this connection, it should be stated that either the sire or dam may sometimes be extremely "prepotent," and thus have more apparent influence on the offspring than does the other parent. In the production of mules, which are hybrids, it is noticed that the mule colt resembles the mare in size and frequently in color; while in persistence and ability for self-protection it resembles the jack.

The improvement of horses and mules through selection and breeding is dependent upon two natural laws, i.e., variation and heredity.

The Law of Variation.—This simply means that no two animals are exactly alike. Through this tendency to vary man is able to improve animals by careful selection.

The Law of Heredity.—This law implies that offspring tend to have the qualities of their parents more than the qualities of unrelated animals. It is clear, therefore, that by selecting the most desirable variations and mating them together the breeder is likely to bring about an improvement. It is necessary that the breeder have definitely in mind an ideal toward which to work and that he be skilled in recognizing and utilizing qualities in animals which tend toward that ideal.

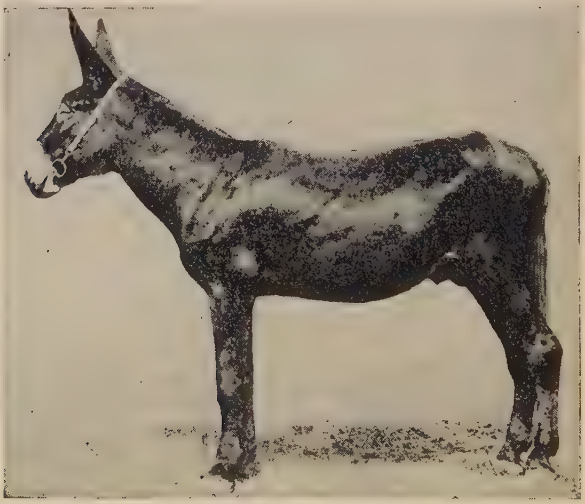


Fig. 112.—A prize-winning jack showing good size of bone and plenty of quality. (U. S. D. A.)

A Community Sire.—Inasmuch as the production of horse and mule colts is largely a side line on general farms, the stallions and jacks used as sires affect the colt crop of an entire community. (Figs. 111, 112.) Stallion laws have done much toward improving the qualities of sires, but there is still room for improvement. In many parts of the country, community organizations have been formed for the purpose of purchasing and maintaining satisfactory sires. It is thus possible to secure a desirable animal and share his service at a reasonable cost. The influence of this sire will tend to produce a uniform lot of colts and buyers will be attracted to the community. A sire should be selected which will get colts of the desired type from the mares which he is to serve. It is usually advisable to secure a tried stallion or jack, being certain that he is free from disease and hereditary tendency to unsoundnesses.

Job 12. Marketing Horses and Mules

Conditions Usually Found.—(1) Producers do not understand market demands. (2) Horses of inferior quality sell for less than cost of production. (3) Animals are sent to market in poor condition.

Aims.—Market grades and classes and methods of selling and shipping should be learned through study and experience.

Problems for Study and Discussion.—(1) How are horses and mules classified on the markets?

2. When is the market demand greatest?
3. In what ways may surplus animals be sold?
4. How should horses and mules be fitted for show or for sale?
5. How should animals be delivered at a distance?

Activities.—(1) Visit a farm or community sale of horses and mules. Record the age, condition, breeding, and price of each animal sold. (2) Attend a show or fair and study the fitting of the animals for the ring. (3) Practise fitting animals for show or for sale. (3) Enter project animals at fairs for competition. (4) Make a market graph showing receipts, sales, and prices for horses and mules over a period of several months.

Importance of Job.—The final and often the most important job in connection with any farm enterprise is the disposal of the product. Even on the farms, where animals are raised primarily for home consumption, surplus animals and those no longer fitted for the particular need must be marketed at a profit if possible. A clear understanding of market possibilities will often mean dollars rather than debits in the producer's bank account.

Market Classes.—The classification of horses and mules on the market is based upon the use for which the animals are intended. Five classes of horses and the principal sub-classes are given: (1) Work—drafter, logger, chunk, wagon, feeder. (2) Heavy Harness—coach, park. (3) Light Harness—roadster and speed. (4) Saddle—race, walk-trot-canter, gaited, hunter, combination. (5) Pony. Mules are classed under the headings draft, farm, sugar, cotton, and mining. Each of these classes is further sub-divided into the grades choice, good, medium, common, and inferior, on the basis of conformation, quality, condition, and soundness. Market quotations are published according to the above classifications.

The demand for work stock, particularly in the country, is greatest in the spring. At this time farm work is beginning and horses and mules are needed to carry it on. It may be advisable, therefore, where a plentiful supply of cheap feed is at hand, to buy horses and mules in the late fall and to dispose of the surplus animals at the beginning of the farming season. The margin between fall and spring prices is narrow, however, so that both feed and labor costs must be small to permit a profit. Horses purchased for city use usually bring the best prices at five or six years of age. Therefore, if the horses are well handled and grown out, the producer will secure two or three years of work before selling.

Disposal.—Surplus animals may be disposed of through either private or public sale. If the producer has only one or two animals for sale, he may sell direct to a neighbor or to a dealer. Horses and mules may be consigned to sales and a percentage of the selling price paid to the salesman or auctioneer. If horse production is a major enterprise on the farm, then some form of advertising should usually be practiced. Advertisements in livestock magazines, circular letters, and exhibiting at fairs are satisfactory means of advertising the stock.

Preparation for Market.—Horses and mules should be carefully prepared for sale if the best prices are expected. For both show and sale, animals should carry a little more flesh than when in normal working condition. This makes them appear heavier, smoother, and neater in all ways. They should be well groomed and trimmed up, with the hoofs properly shaped and oiled. The animals should be trained to lead well and to stand as placed. Every effort should be made to have the horse or mule show to the best advantage, but any attempt to deceive the judges or buyers is a short-sighted policy

Shipping.—Horses and mules may be shipped with very little loss if proper precautions are taken. Cars should be thoroughly disinfected in order to control, at least partially, shipping fever. Open stock cars are probably as satisfactory as closed cars if the weather is not too severe. The cars should be well bedded and partitions strongly built. A good feed of hay before loading is recommended. The law requires that the animals shall be fed and watered periodically while in transit. If the distance to be traveled is short, it is usually advisable to transport the animals overland on their own power. They are sometimes hauled in trucks.

State Experiment Station Bulletins and Circulars.—California Bul. 401; Connecticut, (Storrs) Bul. 132; Illinois, Circ. 283; Bul. 262; Iowa, Bul. 240; Minnesota, Special Bul. 80; Missouri, Bul. 152; Circ. 125, 157; South Dakota, Bul. 212.

Things to Make at Home or in the School Shop.—Large and small gates; feeding boxes; concrete water troughs; stalls; partitions; colt creeps; harness racks; hay racks; feed troughs; salt troughs; medicine chest; horseshoer's tool box; rack for grooming tools; saddle closet; rope and leather halters; saddle pads; collar pads; repair harness.

SWINE ENTERPRISE

By W. H. Smith, B.S., M.S.

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Analysis into Jobs.—The following thirteen jobs include the main managerial and operative teaching points in the swine enterprise. References are to numbers of U. S. Farmers' Bulletins. (See book references at end.)

1. Determining the possibilities with swine. Bul. 985, 1186, 1437.
2. Equipping for swine raising. Bul. 1487, 1490.
3. Selecting the type and breed. Bul. 1263.
4. Starting a herd. Bul. 1437, 1455.
5. Feeding and managing the breeding herd. Bul. 951, 1133, 1357, 1437, 1504.
6. Controlling diseases and enemies. Bul. 781, 834, 1085, 1244.
7. Managing the sow and litter. Bul. 1437, 1504.
8. Growing pasture crops for swine. Bul. 614, 951.
9. Feeding swine for market. Bul. 1455.
10. Showing and selling breeding stock. Bul. 1455.
11. Marketing swine. Bul. 1144.
12. Butchering and curing pork. Bul. 183, 1186.
13. Keeping swine records and accounts. Bul. 511, 572, 782, 1182.

Job 1. Determining the Possibilities with Swine

Conditions Usually Found.—(1) Many farmers try to market a rather uniform number of swine each year and find this plan profitable. (2) Many others try to meet high prices with a supply of swine and go out of the business when prices are low. (3) Beginners are sometimes tempted to raise more swine than their conditions and experience will justify.

Aims.—Students should learn to consider the conditions on their farms and in their regions which will seriously affect the swine industry either favorably or unfavorably.

Problems for Study and Discussion.—(1) Inquire among your neighbors and find how many brood sows are kept by each farmer.

2. Ask these farmers to compare profits in swine raising with those in other lines of farming. Give their conclusions (Fig. 113).
3. How does your county compare with other counties in number of swine? Compare your state with other states.
4. What plans for marketing swine or pork are found in your region?
5. To what extent do farmers raise their own grain or other feeds for swine?
6. Give examples of farms where swine are raised with cattle wastes; dairy by-products; crop wastes; other cheap products.
7. To what extent does your region supply good swine pastures?
8. How would the present prices of corn and hogs place the curve in such a graph as figure 115?

Activities.—(1) Make a graph of prices of market hogs for the past five years.

Let the lines show a comparison of the different years. (2) Continue the ratio curve of figure 2 up to present year.

Demand for Pork.—The large and continuous demand for pork and pork products is an important factor in encouraging the raising of swine. More pork than any other meat is consumed per capita in this country. The amount utilized is fairly constant throughout the year and over long periods of time. Pork is relatively cheaper than beef or mutton and its consumption in times of financial depression is more nearly maintained than that of the higher-priced meats. Swine growers may take advantage of this fact in keeping up their incomes when general conditions are unfavorable toward farming. Hogs are well adapted to supply fresh meat for the home and are slaughtered in large numbers by farmers.

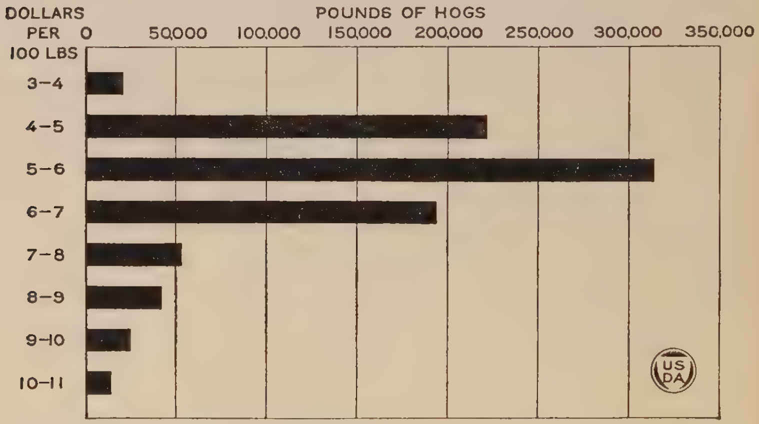


FIG. 113.—Variations in the cost per hundredweight of producing market hogs, based on studies in two counties in Illinois and Iowa. (U. S. Dept. Agr.)

Distribution.—The United States is the leading swine-producing country with a total of approximately 60 million head. Germany ranks second with 26 million head. Hogs are raised in practically every county in the United States. The adaptability of hogs to climatic conditions and different methods of feeding makes it possible to raise them on nearly every farm. The largest numbers, however, are found in the corn-belt states—Illinois, Indiana, Ohio, Nebraska, Missouri, Minnesota.

Labor and Investment.—More and more the question of labor is becoming a vital factor in farming operations. Often swine raising is a useful supplement to other farm practices in utilizing the surplus labor. The labor requirement in caring for a herd of hogs is less than with other classes of livestock, as more use is made of self-feeding devices and of harvesting feeds directly in the fields.

Investment in foundation animals is small and the returns are soon obtained, since the animals reach marketable weight at an early age. (Fig. 114.) Where animals are pure-bred and developed for breeding purposes, the initial investment is larger. In that case the animals are marketed as individuals at a higher price. For successful production of hogs expensive equipment is not necessary. A few buildings to shelter the animals comfortably from extremes of cold and hot weather is sufficient.

Adaptation to Other Enterprises.—Pork production adapts itself to most other types of farming. It is essential to good systems of beef production, as the corn salvaged from cattle droppings is clear gain. Experimental results show that for every bushel of corn fed to cattle, enough feed is recovered by swine following them to produce one to two pounds of pork. Furthermore the by-products of the dairy industry, such as skim-milk, are utilized to advantage in a similar way. Feeds which are somewhat damaged are often valuable as swine rations and in this way may be disposed of at a profit instead of at a loss.

Fig. 114.—Eleven pigs and a good mother make a good start for a ton litter in six months. (Kentucky Station.)

Marketing Factors.—While the demand for pork is rather stable, the price of hogs is influenced materially by the changes in the number produced. When corn is plentiful and other feed prices are relatively low, farmers are inclined to keep more brood sows. Likewise, when hogs are bringing a high price as compared to grain, many farmers start in the business. As swine are prolific (Fig. 114) this practice soon causes an increase in production followed by lower prices. With high feed prices there is a tendency to market the feed and reduce the pork-producing operations. The most successful swine producers (Fig. 115) develop a plan of raising each year a certain number of hogs which fits into their system of farming, considering their equipment, labor, and feed requirements. Others try to vary their production to be in the business when prices are high and out when they are low. This latter plan is seldom successful unless the farmer is a close student of general conditions and is able to determine in advance the probable changes in the market.

Location of Farm.—Feeding and market conditions are important factors in considering the advisability of raising swine. Since corn is the chief feed for producing pork, its availability should have a marked influence on the number grown. In many dairy sections the production of pork could be profitably increased, and a better use made of the dairy by-products. Likewise in strictly grain sections, more hogs could be raised as a means of marketing the surplus crops. Some sections of the country do not produce enough hogs to meet the home demands for meat, although pork products are extensively used for food and certain feeds are available for hog feeding. Farms located close to market centers have an advantage, as hogs are easily trucked to arrive early when the market opens. Many hogs are taken a distance of fifty to seventy-five miles by truck.

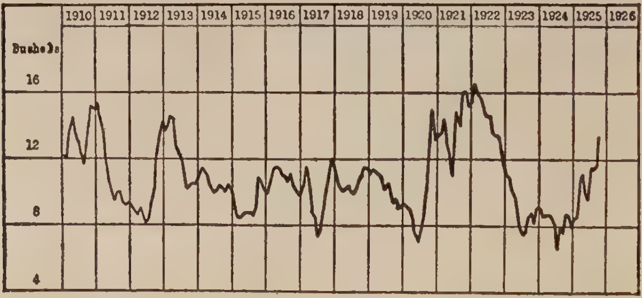


Fig. 115.—Corn-hog ratio curve, 1910–1926. The curve shows the bushels of corn equal in value to 100 pounds of live hogs at average farm prices.

Ratio of Corn to Pork.—The feeding of swine for profit is dependent upon the relation existing between the prices of feed and live pork. Corn is usually the governing feed. Prices of other feeds vary somewhat with the prices of corn. When prices of feed are relatively high, swine cannot be fed profitably. About 560 pounds or 10 bushels of corn are needed to produce 100 pounds live weight of pork. Of course farm conditions and the ages of pigs influence the amount of feed required.

The chart, Figure 115, shows the number of bushels of corn that 100 pounds of live hogs would pay for, based on average farm prices for corn and hogs each month of the years given. When hogs are scarce and corn is plentiful the ratio becomes more favorable for hog feeders.

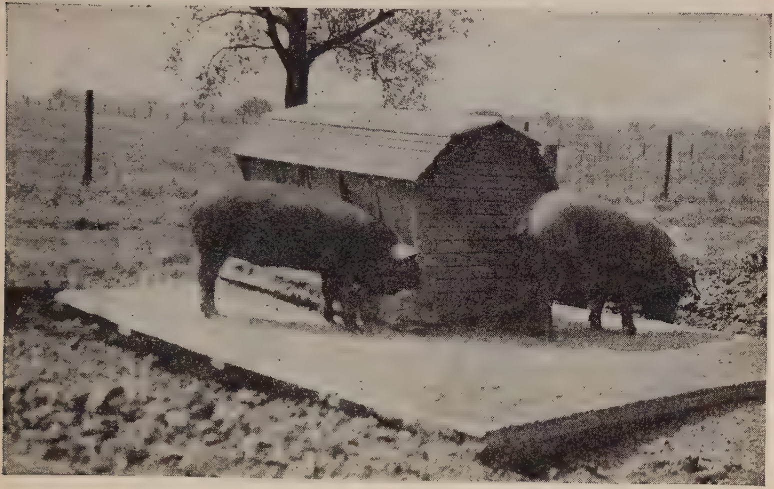


FIG. 116.—If the self-feeder is kept on a platform very little feed will be wasted, and mud is kept out of the feed.

Job 2. Equipping for Swine Raising

Conditions Usually Found.—There is a wide variation in the equipment on different farms. Some farms have too much equipment, others too little. The tendency is toward having too much invested in equipment.

Aims.—Students should understand the different kinds of swine houses and the conditions which call for each type.

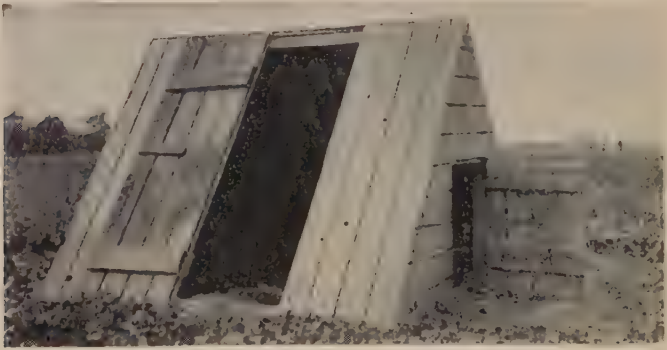
Problems for Study and Discussion.—(1) Which is the more popular type of swine house in your community, the centralized or individual house?

2. Of what materials are the centralized houses constructed?
3. In cold weather what means may be used to supply heat to farrowing houses, both centralized and individual?
4. Considering local prices, what would be the cost of material needed for the construction of an A-type house?
5. Why is the centralized house not well adapted to sanitation?
6. List the items of equipment in addition to houses that are required for swine production.
7. How much of the equipment could you make?
8. Give the arguments for and against floors in portable houses.

Activities.—(1) Draw plans for a permanent swine house, considering sanitation, convenience and cost. (2) Make a list of materials for the construction of such a house. (3) Draw plans for a portable swine cot, and make a list of materials for the same.

Things to Make.—(1) Make a portable swine house such as you have planned. (2) Make a self-feeder. (Fig. 116.) (3) Make a feed trough. (4) Build a shipping crate. (5) Make an insulated cement floor for a farrowing house. (6) Build a concrete hog wallow. (7) Make a concrete feeding floor for the lot. (8) Make a pig creep. (9) Make a watering trough.

The equipment needed for raising hogs need not necessarily be expensive. For commercial pork production only about 3 per cent of the total cost of pork is included in the cost of equipment. Houses to provide shelter are the most costly items. For satisfactory results hogs must be protected from cold in winter and from heat in summer. At other seasons little use is made of buildings.



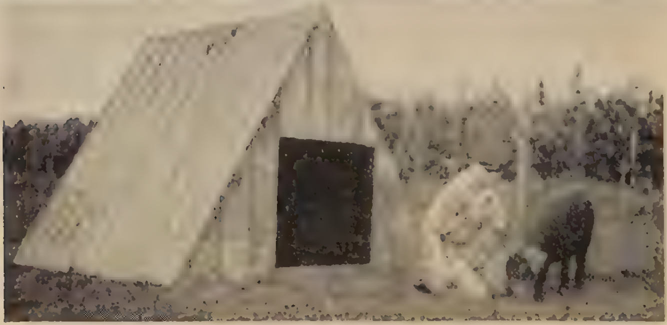
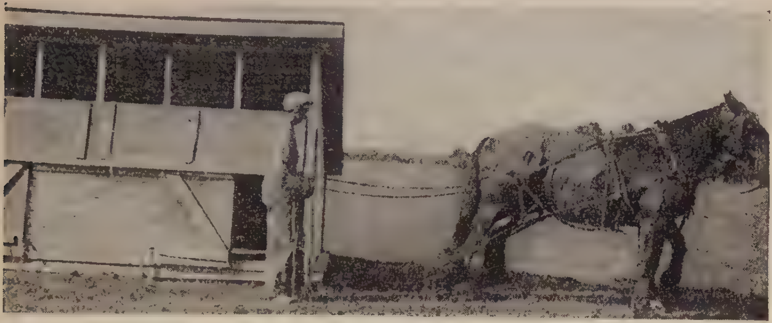


Fig. 117.—A-type portable farrowing house. The extra door with roof allows entrance of sunshine.

Fig. 118.—Individual A-type of portable house for sow and litter.

Types of Houses.—Hog houses may be classified as the small or individual, and the large or centralized types. The individual house is used for one sow and her litter (Figs. 117, 118, 119), while the centralized structure accommodates a large number of sows and their offspring. Where only a few sows are kept on the farm it is not economical to go to the expense of erecting a large house. Farrowing quarters may be provided considerably more cheaply by using the individual rather than the large houses. Even where the central type is used it is too expensive to provide a farrowing pen for each sow in the herd. A better plan is to provide farrowing quarters for only about one-third of the sows, and move the early litters to individual houses on pasture as space is needed for the animals bred for later farrowing. This scheme is necessary for swine sanitation as well as advisable from the standpoint of lowering the cost of equipment (Figs. 131 and 132).



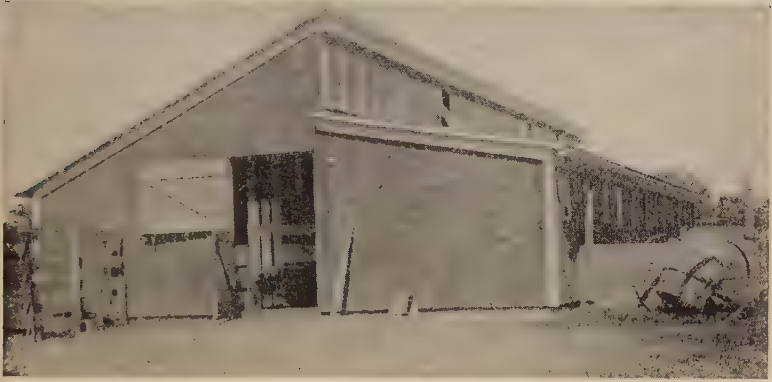


Fig. 119.—Moving a double-unit farrowing house to fresh ground.

Fig. 120.—Permanent hog house, 24 x 60 feet, pens 5 x 10 feet, alley 4 feet wide. (C. L. Moore, Tremont, Ill.)

The Centralized Hog House.—(Fig. 120). The location of the farrowing house should be given first consideration. A well-drained site, conveniently located in respect to other farm buildings, should be selected.

There is no one best kind of material for hog-house construction.

Wood, hollow tile, brick, and concrete are all satisfactory. Regardless of the kind of material or the type of structure chosen, there are a number of important factors that should be considered. The house should be warm, well ventilated, easily cleaned, and constructed to permit as much direct sunlight as possible to enter the farrowing pens. Other essentials are economy of construction and convenience.

A double row of pens with an alley between is the usual arrangement in the interior of the house. An extremely wide alley is not to be recommended, for two reasons. Obviously, the wider the alley the greater the cost. Also, a wide alley increases the air space, which makes the house more difficult to warm in cold weather.

The sizes of farrowing pens depend upon the sizes to which the sows are grown. A pen 7 by 8 feet is sufficiently large for well-grown immature sows. Where sows are not grown to large weights or where gilts are used, a pen 6 by 7 feet is satisfactory.

The interior of the house should be constructed to facilitate cleaning. This calls for smoothness of construction with an absence of crevices and ledges which tend to collect filth. A concrete floor is best from the standpoint of cleaning. It is, however, cold and damp. This objection may be overcome by providing board over-lays for the farrowing pens. These false floors should be removed except during cold weather, for the bare concrete is cooler and more satisfactory during the hot months. The top layer of concrete of the winter farrowing bed is sometimes insulated by using a layer of tar or of tar paper. This top layer then holds the heat.

Proper inside drainage is another essential feature to a good farrowing house. The farrowing floors should slope to the center rather than toward the wall. A shallow gutter on each side of the alley should provide for carrying off the surplus water.

The pig rail, to prevent sows from lying on their pigs, is an inexpensive but important item of equipment for the farrowing pens. These rails should be about 8 to 10 inches high and extend out about 6 to 8 inches from the walls of the pens.

Feed Storage.—Some space should be available for the storage of feed and other supplies. With the more elaborate houses it may be advisable to build a separate room for this purpose. With the smaller houses one of the farrowing pens may be used.

The Individual House.—In recent years there has been a tendency to get away from centralized houses and to use individual houses entirely. Although a little more work is required in taking care of the pigs with the latter method, better results are secured.

The time of year the pigs are to be farrowed should be considered in planning the individual house. Where pigs are farrowed in cold weather, a well-built house is required. In case of farrowing in mild weather, or where pigs are kept in the central house until a few days old, a cheaper structure will suffice.

The A-Type House.—A great deal of favorable attention has been given the A-type house (Fig. 120), principally because of its relative cheapness and convenience. For this type of structure only about 200 board feet of lumber is required. Some lumber is saved in the construction, as there is usually no floor in this house. There is also an advantage in favor of the A-type house in the cost of building, as 2-by-4-inch pieces may be used in place of 4-by-4 timbers for the framing at the ground. This house may be moved by loading on a sled or low wagon.

One of the most frequent objections lodged against the A-type house is that the side boards may be loosened by the sows pushing against them. This condition may for the most part be remedied by nailing a 1-by-6-inch board on the inside. This supports the siding when the sow rubs against it. The same thing may be accomplished by putting the framing pieces on the outside of the house at the ground. For early spring farrowing it may be desirable to supply a floor and possibly a door to this type of house. To facilitate cleaning, the floor should be removable. Only about 50 board feet of lumber is required to make a platform that will serve this purpose.

Job 3. Selecting the Type and Breed

Conditions Usually Found.—There are several breeds found in most communities. Each breed has its merits and strong supporters.

Aims.—Beginners should study carefully each breed before making a decision.

Problems for Study and Discussion.—(1) What types of swine are found in your county?

2. List the breeds of swine found in your community and give the approximate number of each.
3. How does the distribution of the breeds in your community compare with that found in the rest of the county and state, or in the United States?
4. Rank the different breeds as to size of the individuals.
5. In which sections of the country are the bacon breeds most common?
6. What feeds are especially adapted to bacon production? To the production of lard or fat swine?
7. Describe the breeds of your region.
8. Give the advantages and disadvantages of each of the leading breeds.

Activities.—(1) Practise judging swine of different breeds found in your region. (2) Assist a shipper in sorting fat hogs for shipment. (3) Assist in culling breeding swine.

Choosing the Type.—The variation in the use of animals and their products has resulted in the development of different types. In case of swine, which are used chiefly for the production of pork and pork products, we have the lard and bacon types.

Because corn has always been our chief crop, and is an important fattening feed, 95 per cent of the hogs in the United States represent the lard type. In Canada, on the other hand, and in parts of the United States where fattening feeds are not so abundant, the bacon type predominates.

The fat or lard type is so called because of its tendency and ability to change feed into extreme amounts of fat over the body. The body of the lard hog is the most efficient meat-producing form among farm animals. This is due to their compactness, their ability to carry extreme amounts of fat, and their relatively small stomach and intestinal capacity. Some hogs carry as much as 40 per cent of their live weight in the form of fat and sometimes dress as high as 89 per cent.

The bacon type (Fig. 127), on the other hand, is one that furnishes a large percentage of bacon, which is the cured meat taken from the sides of the hog. Unlike the lard type, the bacon type is free from the thick deposit of fat over the body. A long body with deep sides, narrow back, and smooth shoulders and rump is the most desirable.

Determining the Breed.—Both types of hogs are divided into breeds which have different colors, sizes, and forms. In selecting a breed of hogs the decision should be based on the availability and price of foundation stock and upon personal preferences of buyers. Ordinarily the breed most prevalent in the community has the advantage on account of the wider selection of available individuals and the greater chance of selling surplus stock. While there are many different breeds, most of the hogs of this country are represented by eight breeds. There is no "best breed"; each has its good characteristics. The feeding and disease-resisting qualities are very similar in all breeds.

Like our early cattle and horses, the hogs first brought to this country came from England. While the early colonists brought hogs with them, all our breeds have been established within the last century. Today there are more than a dozen breeds of hogs in this country. Four of these breeds were brought from England and have been kept pure. All the remainder have been developed in America by the crossing of a number of different sorts and later by selecting and breeding for definite ideal types adapted to the conditions throughout the land.

Lard Type Breeds.—The Duroc-Jersey (Fig. 121) is a comparatively young breed of lard hogs. It has descended from red hogs of uncertain origin, but probably carries some of the blood of the sandy Berkshire and of the early red hogs imported from Spain.

The Duroc-Jersey is of solid red color which varies from yellowish to dark. A cherry red describes the shade most preferred. The head is medium in size with the forehead broad, the face slightly dished, and the ears large and somewhat drooping.

The form of the Duroc-Jersey shows the characteristic lard type with a high arched back, smooth sides, and good feet and legs. As a breed the Duroc-Jersey is strong in constitution and produces large litters.

The Hampshire.—Up until about 1910, little was done to promote the Hampshire breed, which was then of the bacon type. The adoption of this breed throughout the corn belt has developed them into a type closely approaching the other lard hogs in form, although they are smaller in size. During recent years these hogs have rapidly increased in popularity.

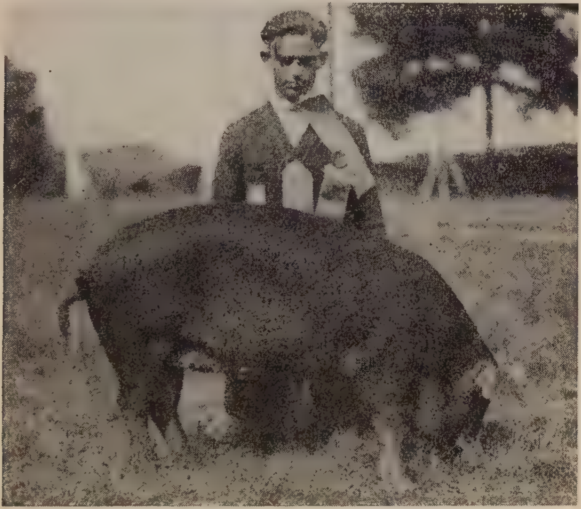


FIG. 121.—Young swine grower with his winning Duroc-Jersey gilt. Illinois State Fair.

The Hampshire is known as the belted hog. (Fig. 122). It has a black color with a characteristic white band of varying width encircling the body at the shoulders. Compared to the extreme lard type of animal, it shows a lighter neck, shorter body, and somewhat narrower hams. These hogs are quite prolific and show good constitution. They are good feeders, finish smoothly, and dress out a uniformly high percentage.

The Poland China originated in Southwestern Ohio about 1840 from a foundation consisting of a large number of different breeds, among which was the Berkshire. The Poland China breed has varied considerably in type from time to time until recent years, in which the big type has been almost universally established. In color this breed closely resembles the Berkshire except that more white spots often appear. (Figs. 123 and 124). It represents an extreme lard type and is characterized by smoothness and thickness of covering and an extreme arch of back. The head is medium in width with a straight face, while the ears have a stylish curve forward.

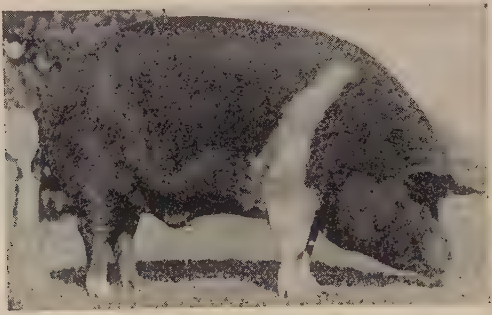


Fig. 122.—Champion Hampshire barrow, 18 months class, weight 620 pounds, bred by University of Illinois. Heavier than most markets demand.

The Spotted Poland Chinas are a large breed of fat hogs. They resemble the Black Poland Chinas in general form. (Fig. 124). The color, however, is spotted, as the name indicates. An ideal color is one that is 50 per cent black, and 50 per cent white, although animals are accepted with but 20 per cent of either color. The size, prolificacy, and

Fig. 123.—Poland China gilt and young owner.

feeding qualities of this breed have made it popular with farmers and a large increase in the number of herds has been noted.

The Chester White is the oldest of the lard-type breeds developed in this country. It was first established in Chester county in eastern Pennsylvania about 1820. The foundation swine were the white English hogs brought over by settlers.

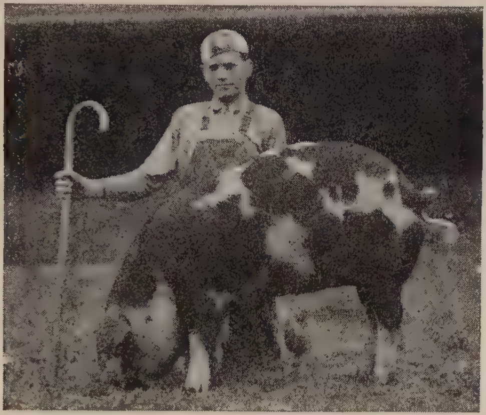


Fig. 124.—Spotted Poland China gilt, a prize winner and young owner.

As the name suggests, this breed is white in color. (Fig. 125). The head is similar in shape to that of the Poland China, but with somewhat larger and heavier ears. Also the width of back and loin and the depth of body are about the same as in the Poland China breed. Chester Whites are good feeders, making rapid gains in weight and finishing

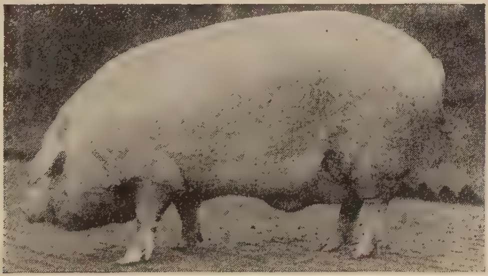


Fig. 125.—Champion Chester White barrow, ideal market type.

smoothly. They are less popular in the South on account of their color, as white hogs often blister in the hot sun.

The Berkshire was the earliest improved breed of swine. It was developed in southern England, and is the only lard-type breed in the United States that did not originate here. Animals of this breed were brought to the United States as early as 1823 and were the first breed of hogs to become established in this country.

The Berkshire is black with six white points, i.e., the four feet, face and tail. The head is the most characteristic feature (Fig. 126). The face is short and often extremely dished, while the ears are stiff and stand erect. In form, the Berkshire has a long body of medium depth and width. The body is covered with uniformly smooth and firm flesh in which the fat and lean are well marbled, and is noted for the high quality of meat furnished.

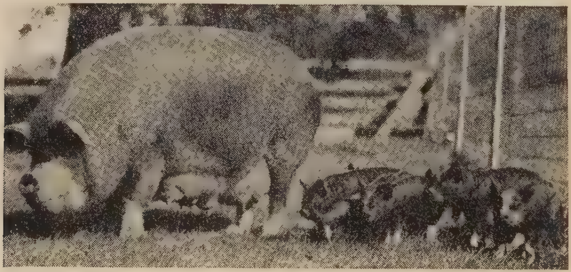


Fig. 126.—Typical Berkshire sow and litter.

The Bacon-Type Breeds are used for producing high-grade cured meat or bacon. Such meat must be of excellent quality with only a moderate amount of fat. It is important that the fat be mixed with the lean in regular defined streaks. The hogs best suited for the production of bacon are long and deep-bodied without the width and fullness that characterizes the lard type.

The breeds of bacon hogs now in this country originated in England. They were the first hogs brought to the United States, but have never become as popular as in other countries.

The Yorkshire.—From early times the County of York in England has been noted for its large white hogs. During the last 150 years these hogs have been greatly improved for bacon production and are known in America as the Large Yorkshire. This breed was first imported into the United States from England about 1893. Because of the recent introduction of this breed and the small demand for bacon hogs, they have not become numerous here. But outside of this country they are one of the most popular breeds, and Yorkshire bacon commands the highest price the world over.

The Large Yorkshire is pure white in color. The head is moderately long with a dish face, and heavy ears pointing forward. The form shows the characteristic bacon type, being longer and more upstanding than that of any other breed. The body is narrow, the back high and well arched, with neat shoulders and hams, and of remarkable smoothness from end to end. Yorkshires are widely known for their rapid growth and excellent grazing qualities. While they are good feeders, like all other bacon hogs they do not fatten as readily as the lard hogs. One advantage of the breed is their prolificacy, litters of twelve to fourteen being common.

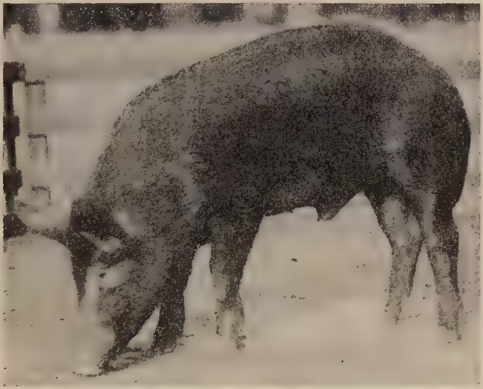


FIG. 127.—Junior champion Tamworth boar, International.
(B. F. Harris, Seymour, Ills.)

The Tamworth.—The natural home of the Tamworth is central England, where it originated in very early times. The Tamworth seems to be the most direct descendant of the European Wild Boar and still shows some of his characteristics. As far as is known this breed has been developed entirely by selection, with no cross breeding. It is pure red in color.

This breed shows the most extreme bacon form (Fig. 127). The head is very long and pointed, with large and upright ears, a thin neck and a very light jowl. The body is long and fairly deep but narrow and even in width, and is supported by legs that are long but of fine bone. The shoulders and hams are light, carrying out straight sidelines. Tamworths make rapid growth and produce an excellent grade of bacon.

Job 4. Starting a Herd

Conditions Usually Found.—(1) A herd of hogs can be built up in a short time, as the sows are prolific and the pigs mature rapidly. (2) Some farmers spend too much for foundation animals before they have had experience. (3) When a breeder becomes established he can afford to invest more money in breeding animals.

Aims.—How to choose good breeding swine and how best to procure foundation stock should be well understood.

Problems for Study and Discussion.—(1) How many pure-bred herds are in your community?

2. Find how some of the herds were built up.
3. What breeds are found in your county?
4. Outline the steps in building up a herd.
5. Find from breeders what prices are charged for surplus animals.
6. Ask breeders if they would coöperate in the ownership of a good pure-bred sire.
7. Make a list of the numbers, ages, and prices of animals you would need to buy.
8. How can you finance the starting of a herd?

Activities.—(1) Obtain the registration papers of a pure-bred herd of sows. Make a table showing the number of pigs produced by each sow and the size of the litter of each dam. (2) Make a table of the ton litters produced in your region recently, giving the name of the owner, number of pigs in the litter, weight of the litter at six months of age, cost of feed, and price received. (3) Show by graph line the profits from each of these ton litters. With the second line show the number of pigs per litter.

The development of a good herd should be the ambition of every breeder. To achieve this the foundation stock must be wisely selected and the sows which are retained each year for breeding purposes must be carefully culled. With a good breeding herd developed in this way a farmer can produce his own stock to feed or to sell as breeding stock to others.

Pure-breds vs. Grades.—The advantages of pure-breds over grades are sufficient to warrant a beginner purchasing foundation animals that are pure-bred. Usually it is not necessary to pay exorbitant prices for good individuals. It is possible to secure animals of approved type and breeding at prices which would justify the extra cost over that of grade stock. The advantages of pure-breds over grades are that the pigs from pure-breds are more uniform, are ready for market at an earlier age and make better use of their feed than common or grade individuals.

Probably the most outstanding results showing the value of pure-bred boars are found in the production of ton litters. In Illinois 359 official ton litters had been produced up to 1927. Of that number 335, or 93 per cent, have been sired by pure-bred boars. The remaining 21 litters were sired by boars that were practically pure-bred. A more significant demonstration of the importance of using better sires in the production of pork would be difficult to imagine. When the value of a pure-bred boar can be expressed in terms of increased pounds of pork, as is the case in the production of ton litters, pork raisers understand the language used.

Purchasing Foundation Stock.—In selecting foundation stock a good plan is to purchase good individuals of well-known breeding from a reliable breeder. One of the best ways to start is to buy a few bred sows and gradually develop the herd from these and their offspring. A few female pigs may be secured as the foundation stock (Fig. 128).

Selecting Individuals.—The ability to select swine that meet certain requirements in the feed lot or breeding pen or on the butcher's block depends upon a thorough knowledge of the detailed parts which make up the bodies of the individuals. These parts are given special names in each class of livestock and these as well as their location must be thoroughly fixed in mind before a breeder can be rated as an intelligent judge.

Fig. 128.—Frances Muth made a good start for a swine herd with pure-bred Duroc-Jersey pigs.

Names of Parts.—(Fig. 129).

The *snout* is the extreme lower part of the head or the extension of the face. It corresponds to the muzzle in cattle.

The *face* is the front part of the head below the eyes. A dished face is one that shows a depression between and just below the eyes.

The *jowl* is the fleshy development under the lower jaw and throat.

The *head* includes all the parts mentioned from the snout to the neck.

The top part of the head between the ears is sometimes called the *poll*.

The *crest* is the top portion of the neck.

The *breast* is the front part of the body between the forelegs.

The *chest* is the cavity between the shoulder and directly behind the forelegs.

The *ham* is the muscular development of the thigh extending from the *rump* down to the *hock*.

An *arched back* is one showing a high curved line when viewed from the side.

The *sides* are the outer portion of the body between the shoulder and hams.

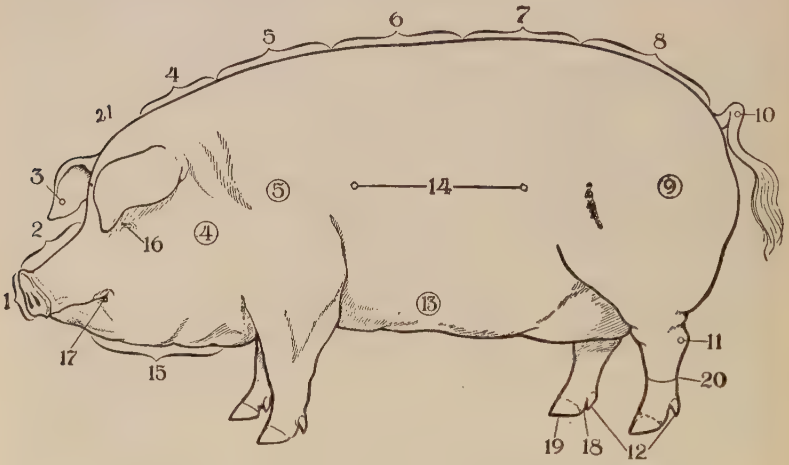


FIG. 129.—Parts of fat hog. (American Duroc-Jersey Association.)

1. Snout, short not coarse.
2. Nose, not too long.
3. Ears, well carried, fine, medium size.
4. Neck, thick, short, smooth to shoulder.
5. Shoulder, broad, deep, smooth, compact on top.
6. Back, broad, slightly arched, thickly and evenly fleshed.
7. Loin, wide, thick, strong.
8. Rump, long, wide, evenly fleshed.
9. Ham, heavily fleshed, full, firm, deep, wide.
10. Tall, not coarse.
11. Hock, vertical viewed from rear.
12. Dew-claws, carried well up.
13. Belly, straight, smooth, firm.
14. Side, deep, full, smooth, medium length.
15. Jowl, full, firm, broad, neat.
16. Eye, large, full, clear, wide apart, not obscured by wrinkles.
17. Tusk, not coarse.
18. Pastern joints, short, strong, upright.
19. Feet, medium size.
20. Bone measurement, medium size, clean, strong.
21. Forehead, broad.

The *shields* are the hard calloused development which appears on the shoulders of a mature boar or stag. *Tushes* are the large pair of teeth which appear on the lower jaw of a boar. *Black teeth* are long sharp teeth, which sometimes are found developed on pigs at the time of birth. *Bristles* are the stiff, erect hairs which are found on the top of the neck or crest. A *swirl* is a rosette or circular parting of the hair. This is objectionable and is discriminated against in show and breeding hogs, but it does not affect the usefulness of the animal. Swirls, if present, usually appear on the sides and back of a hog.

The *belly* is the lower surface of the body which joins the two sides.

The *pastern* is the bone or ankle which joins the toes to the leg and corresponds in position to that of a horse. A *cocked ankle* is one that is bent forward and out of line with the rest of the leg.

Dew claws are the small undeveloped toes on the back part of the leg at the upper pastern joint.

Other Descriptive Terms.—

A *boar* is an entire male of any age. A *barrow* is an unsexed male castrated at an early age. A *stag* is a male castrated after showing maturity. A *gilt* is a female under one year of age.

A *pig* is a male or female up to the time it reaches the approximate weight of 125 pounds. Pigs are sometimes called *shoats*. An animal above this weight is generally spoken of as a *hog*. *Swine* is a general term including pigs and hogs of both sexes.

When a sow gives birth to pigs she is said to *farrow* and is known as the *dam* of the litter. All the pigs farrowed at one time are known as the *litter*. *Prolificacy* is a term which refers to the number of pigs in a litter, and sows producing large litters are spoken of as being *prolific*.

When a hog is butchered there is very little waste, as only the *bristles* and *offal* are removed. The *skin* is not removed as in other meat animals because it grows fast to the body, forming a *rind*. The dressed meat is known as *pork*. The surplus fat is trimmed off and rendered or heated, and forms *lard*.

Selecting Lard-Type Swine.—Since the final end of any hog is the butcher's block and his demands must be met, it is advisable to study the selection of animals from the market or butcher's standpoint. The first step in the procedure is to become familiar with an ideal type which the butcher demands. Such a type is found in an animal which has a body furnishing the largest proportion of desirable meat and the smallest percentage of offal or waste when slaughtered. To fill these requirements the animal must be strictly meat-producing in form, good in quality and prime in condition.

The form of an animal includes the shape of its body and the relative developments of its various parts. The form of the lard hog which furnishes a large percentage of salable meat is practically rectangular, with a wide back, deep full sides, broad and deep hams and shoulders, and a thick neck. This type is characterized by the fullness of all its parts and the smoothness with which they are blended together. Such a body is symmetrical in every way and unusually free from large extremities, narrowness, and roughness of any kind.

The quality of a hog is the kind or the texture of the hair, hide, bone and flesh that he possesses. To be of good quality he must have a trim, neat head, fine hair and bone, and smooth, firm flesh. Poor quality in a hog may be indicated by any of the following points: large, coarse head, heavy drooping ears, rough coat of hair, large porous bones, wrinkled hide, flabby flesh.

Indications of quality are important, as they reflect the kind of carcass the animal will furnish when slaughtered as well as the grade and amount of desirable meat. An animal with soft or flabby flesh is undesirable as this makes a low grade of cured meat and is therefore objectionable to the butcher.

Condition.—By *condition* of a hog is meant the amount of flesh and more especially the amount of fat he carries. Hogs can be made fatter in a shorter time than any other class of livestock. This high state of condition largely accounts for the high dressing percentage for which they are noted. The amount of fat on a hog is usually difficult to determine, since the hide is thick and grows fast to the flesh, as is the case with no other farm animals. Some indications of high condition are fullness of jowls, covering over shoulders, squareness of back and loin, and fullness at the flanks and lower hams. If an animal is low in condition its shoulders usually appear open and prominent, the back and loin narrow, and the hams light and pinched. Extreme high condition is easy to recognize and is undesirable, since it generally causes flabbiness and wrinkles or creases to appear on the sides of the body and neck.

The head is broad between the eyes and short in the face with the jowls medium in size and the neck short, full and joined smoothly to the shoulders. The neck is the cheapest part of the hog carcass and excessive weight in this region is therefore undesirable.

The shoulders are round and full without being open on top or prominent on the side.

The back is wide and arched, the ribs well sprung, the sides deep and carried even from the shoulders to hams with the flanks full. The loin is broad and thick. The rump is wide and long, providing large surface for the attachment of the hams. The hams are thick, deep and long with fullness down to the hocks.

The legs are straight and set wide apart, the pasterns short and strong, allowing the animal to stand up on his toes. A fat hog has great weight for its size and therefore requires strong legs for proper support.

SCORE CARD FOR LARD TYPE

	Perfect Score
GENERAL APPEARANCE, 30 PER CENT:	
1. *Weight*, according to age	4
2. *Form*, deep, broad, medium length, smooth, compact, symmetrical; standing squarely on moderately short legs	10
3. *Condition*, fat, well finished; deep, even, firm yet mellow covering; free from rolls or flabbiness	10
4. *Quality*, hair smooth and fine; bone of medium size, clean, and	

strong; smooth, refined general appearance; free from creases and wrinkles	6
HEAD AND NECK, 8 PER CENT:	
5. *Snout,* medium length, not coarse	1
6. *Eyes,* able to see; prominent, clear, not obscured by fat	1
7. *Face,* short and clean; cheeks full	1
8. *Ears,* fine, medium size, attached neatly	1
9. *Jowl,* full, firm, neat, free from wrinkles	2
10. *Neck,* short, full, smooth to shoulder	2
FOREQUARTERS, 12 PER CENT:	
11. *Shoulders,* broad, deep, smooth, compact on top (Fig. 9)	8
12. *Breast,* full, smooth, neat	2
13. *Legs,* straight, short, strong; bone clean, hard; pasterns short, strong, upright; feet medium size	2
BODY, 36 PER CENT:	
14. *Chest,* deep, wide, full; large girth	4
15. *Sides,* medium length, deep, straight, smooth; free from creases and wrinkles (Fig. 10)	8
16. *Back,* broad, uniform in width, strongly arched; thickly and evenly covered (Fig. 12)	9
17. *Loin,* wide, thick, strong; same width as back	9
18. *Belly and underline,* straight, smooth, firm, flanks low and full	6
HINDQUARTERS, 14 PER CENT:	
19. *Rump,* long, wide, evenly fleshed; not steep	3
20. *Hams,* long, thick, wide, deep, plump, firm; not baggy (Fig. 11)	9
21. *Legs,* straight, short, strong; bone clean, hard; pasterns short, strong, upright; feet medium size	2
Total	100

SCORE CARD FOR BACON TYPE

	Perfect Score
GENERAL APPEARANCE, 35 PER CENT:	
Size—Well developed for age	5
Form—Long; smooth, all parts proportionately developed so as to give the impression of a well-balanced, strongly-built animal. Topline, strong; underline, straight; belly, trim and neat	10
Quality—Hair, fine; skin, smooth, showing no tendency to wrinkle; bone clean and strong but not coarse; flesh, firm and smooth, with no flabbiness at jowl, foreflank, belly, or ham	10
Condition—Well covered with firm flesh, especially along back and loin, but not heavily loaded with fat	6
Style—Active and sprightly, walking without a swaying movement, and standing well up on toes. Breeding animals should show strong character	4
HEAD AND NECK, 8 PER CENT:	
Snout—Medium length and moderately fine	1
Face—Broad between eyes; poll, broad and full	1
Eyes—Good size, full, and bright	1
Jowl—Fair width and muscular, but very neat, showing no flabbiness	2
Ears—Moderately thin, and fringed with fine hair	1

Neck—Medium length and muscular, but possessing no tendency to arch on top	2
FOREQUARTERS, 13 PER CENT:	
Shoulders—Smooth, somewhat rounded from side to side over top, and very compact; no wider than back, and not running back on side so as to shorten distance between shoulders and ham	6
Breast—Good width and full	3
Forelegs—Set well apart, medium length and straight; pasterns, upright; bone, clean and strong; feet, medium size and strongly formed	4
BODY, 30 PER CENT:	
Back—Medium width, rising slightly above the straight line, and forming a very slight arch from neck to root of tail	6
Loin—Wide as rest of back, strong and full, but not unduly arched	5
Ribs—Good length and moderately arched	4
Side—Fairly deep; long, smooth, and straight between shoulder and ham; a straight-edge laid over shoulder point and ham should touch the side throughout	8
Heart Girth—Full, but not flabby at foreflank, filled out even with side of shoulder; there should be no tucked-up appearance back of forelegs nor droop back of shoulder top	5
Flank—Full and low	2
HINDQUARTERS, 14 PER CENT:	
Rump—Same width as back; long and slightly rounded from a point above hips to tail, and somewhat rounded from side to side over top	4
Ham—Full without flabbiness; thigh, tapering towards hock without wrinkles or folds, and carrying flesh well down towards hock	6
Hindlegs—Medium length, hocks set well apart, but not bowed outward; bone, clean and strong; pasterns, upright; feet, medium size and strongly formed	4
Total	100

Job 5. Feeding and Managing the Breeding Herd

Conditions Usually Found.—Careless methods of feeding and management cause heavy losses. These are avoided on many farms where care is taken to follow approved practices.

Aims.—Beginners should learn the best methods of feeding and managing the breeding herd of swine.

Problems for Study and Discussion.—(1) What are the most common rations fed in your community?

2. Do the farmers grow or purchase their feeds?
3. About what age should the spring gilts be separated from the fattening hogs if they are to be used for breeding purposes?
4. List several different rations for breeding gilts from the time they are separated from the fattening hogs until they are bred.
5. What is meant by the maintenance requirement?
6. Compare the ration of the mature sow with that of the gilt during the gestation period.
7. What is the objection to allowing brood sows to become heavy and fat?
8. How can you plan so the brood sows will obtain regular exercise?
9. How would you solve the exercise problem for the boar?

Activities.—(1) Mix rations for brood sows. (2) Make a trial to compare feeding by hand and by self-feeders. (3) Practise ringing the noses of swine.

Special Feed Needed.—Gilts that are to be developed for breeding stock should not be kept with the pigs that are being fattened for the market. They should be selected soon after weaning and fed a ration that tends to promote growth rather than fattening. A ration should be fed that is high in protein and minerals, the substances required in muscle and bone development. (Fig. 130.)

Grain should be Limited.—Quite often simply a reduction in the amount of grain being fed in the fattening ration will make a feed well suited for feeding breeding stock. This is true when the fattening ration consists of corn or other cereal grains and tankage or skim-milk on good legume pasture.

FIG. 130.—Spring pigs in creep eating from self-feeder and trough. (B. F. Harris.)

Oats, because of the higher content of protein and mineral, are superior to corn for breeding stock. Wheat middlings are usually too high in price to be used economically for fattening hogs for market, but a limited amount may be used for growing out animals for breeding purposes.

A Mixture of Oats and Middlings.—Equal parts of ground oats and wheat middlings with five per cent of the ration tankage and five per cent linseed meal will give splendid results on good legume pasture.

A small amount of corn may be fed with this ration; although this should be determined by the condition of the animals. If the sows get too fat the ration should be cut down. If skim-milk is available it may be used to replace the tankage and linseed meal.

Age for Breeding Gilts.—Every permanent breeder should select some gilts from the best dams with which to build up his herd. Enough should be selected to replace the culled brood sows and to increase the size of the herd according to his plans.

The age for breeding depends upon the development of the gilts. If they are well developed and of good size for their age, their strength and vigor will probably warrant breeding at eight or nine months of age. This will cause them to farrow shortly after they are one year old. Gilts which are small or underdeveloped should not be bred for another month or more. Many good breeders prefer not to breed young sows before they are about one year old. If a fixed farrowing schedule is being followed on the farm this plan avoids interrupting the schedule. Delay until this time allows development of the mammary glands and more pigs are likely to be farrowed and developed.

The Breeding Season.—If spring gilts that are farrowed in February or March are well grown they may be bred in the fall to farrow the following spring. Gilts grown for breeding purposes should not be fat but should be in a thrifty, growing condition. If March pigs are desired, breeding should start about November 7, as the normal gestation period is about 114 days. The old sows which have had fall litters and are being retained in the herd are also ready to breed the first of November as their pigs farrowed in September are old enough to be weaned at that time.

As the breeding season approaches the feed of the sows should be increased. This practice is called *flushing* and is thought to increase the size of the litter.

Number of Litters per Year.—In cold climates one litter per year from each sow is the general rule. In this case early spring litters are usually preferred. In central latitudes many swine breeders plan to have sows farrow once about every eight months. In southern regions two litters per year is the general rule. When two litters per year are desired, the following schedule may be used.

December 10, Breeding date.
April 1, First farrowing date.
May 31, Weaning first litter.
June 10, Rebreeding date.
October 1, Second farrowing date.
November 30, Weaning second litter.

Handling the Boar.—As the breeding season approaches special attention should be given the boar. Like the sows, he should be fed a ration which contains an abundance of protein and mineral. The boar should be forced to exercise if he does not do so of his own accord.

Hand mating is more satisfactory than permitting the boar to run with the sows. The former method will conserve the energy of the boar and in addition will make it possible to keep records as to the time the sows will farrow.

The number of sows that may be bred to one boar depends upon his age and vigor. A mature animal in vigorous condition may serve ten to fourteen sows a week if they are properly distributed. A boar under a year of age should be used carefully. If well grown and vigorous he may be used on one sow each day.

Handling the Sows During the Gestation Period.—It is not advisable to feed aged sows and gilts in the same herd together. The young animals need a ration which provides for growth as well as for maintenance and the developing litter. If aged sows are on good legume pasture a small amount of corn will be sufficient during the first half of the gestation period. During the latter part of the period one-half pound of tankage should be added to the ration daily. When pasture is not available good-quality alfalfa hay fed in a rack may be substituted. For gilts, tankage should be fed during the entire period and increased during the latter part. If skim-milk is available it may be used in place of tankage.

Oats make splendid feed for pregnant sows and should be substituted for a part of the corn when the costs of the two feeds permit. Wheat, barley, and rye may be ground and used to good advantage in the ration.

Exercise is essential if strong, vigorous pigs are to be farrowed. During the summer there is no trouble in getting the sows to take sufficient exercise. During the winter it is a different proposition and various schemes must be resorted to in causing sows to exercise. Where alfalfa hay is fed in a rack considerable exercise will be taken in eating this feed. Another plan that is often used is to locate the sleeping quarters a distance from the feeding place. Sometimes sows are turned loose in a large corn field where there is some corn available, which causes them to forage around and exercise.

Culling Brood Sows.—Each year the swine breeder must decide whether or not to retain all the sows he has been using. There are several reasons why he should cull out sows from time to time instead of rebreeding them. (1) They may be too fat and clumsy, or too old. (2) They may be poor sucklers and not raise their pigs well. (3) They may have bad habits regarding the care of their litters. (4) They may farrow small litters. (5) They may become diseased or crippled.

Breeders seldom keep sows beyond the age of four or five years. A few outstanding exceptions to this rule are found. Breeders sometimes buy old sows from others in order to obtain the blood lines for their own herd. It is not profitable to keep sows in the herd which are too heavy and clumsy and consequently kill pigs by lying upon them. Sows which do not give sufficient milk for their litters should also be marketed, as it is essential in successful pork production for the litter to have ample nourishment for rapid growth and development immediately after being farrowed. Occasionally a sow will develop the habit of killing and eating her pigs. Such a sow should be removed from the herd and marketed, as this fault usually grows worse with age and invariably causes loss and disappointment. Some sows become so nervous that they are not successful in raising their litters. Records should be kept of the number of pigs farrowed and raised by each sow, whether they are pure-bred or grade. Sows should never be kept unless they are healthy in every way. Crippled sows should never be rebred.

Culling Old Boars.—Some of the same principles are involved here as for culling sows. Boars sometimes become poor breeders because of age, condition, disease, or vicious habits. If boars are of very valuable blood lines they are sometimes retained longer than they otherwise would be, with detriment to the herd. Good breeders seldom keep boars after they are too heavy for good service or after they are more than four or five years of age.

Job 6. Controlling Diseases and Enemies

Conditions Usually Found.—The condition of pig pens and lots on many farms is the chief factor in the spread of worms and other parasites among young pigs. Results indicate that by following a strictly sanitary plan the number of sows can be reduced practically one-fourth to one-third and still produce the same number of pigs.

Aims.—How to prevent diseases and parasites, and how to manage when these are found should be well understood.

Problems for Study and Discussion.—(1) How many farmers in your community use sanitary methods with swine?

2. List the four steps in sanitary measures against intestinal worms.
3. Give briefly the life cycle of round worms.
4. What differences do you notice in the times pigs are marketed on farms where swine sanitation is practised as compared with other farms?
5. Why are not newly farrowed pigs immediately infected by round-worm eggs that are in the droppings of their mothers?
6. What swine diseases are most common in your community?
7. Give different methods of applying crude oil to pigs for controlling lice.
8. Give directions for treating swine against cholera.
9. At what age should this be done? Why?

10. What are the regulations in your state regarding the use of materials for treatment against cholera?
11. Describe a good method of treating hogs which have lice.
12. How can lice be prevented?

Activities.—(1) Treat swine with oil for lice. (2) Disinfect and renovate a swine house (Fig. 131). (3) Vaccinate pigs against cholera by the double treatment. (4) Disinfect and renew a hog wallow. (5) Make a mopstick with which to oil swine for lice. (6) Make a dipping vat.

The annual death rate with swine is higher than that with horses, cattle, or sheep. In addition to the high death rate, there is heavy loss due to stunted and uneconomical growth. Prevention by means of proper sanitation will do much to reduce this damage. Not only does sanitation greatly lessen the danger of infection from worms and filth-borne diseases, but it also makes the pigs better able to resist other diseases, because of high vitality.

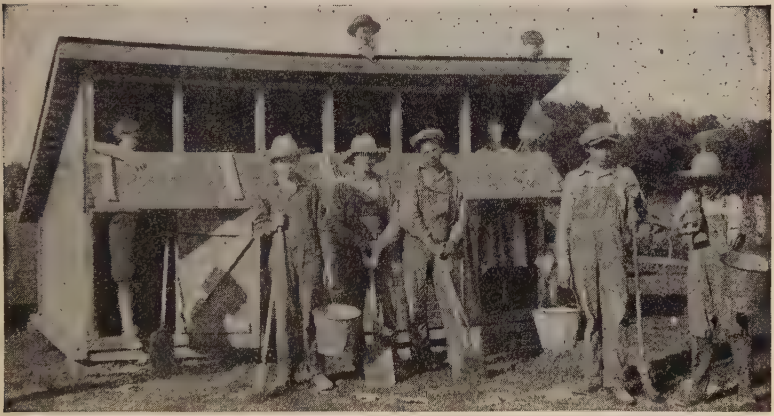


FIG. 131.—Sanitation practice in cleaning out hoghouse.

Improvements in sanitation may be made on many farms in several ways: (1) open sunny houses (Fig. 132); (2) good ventilation in permanent houses; (3) clean quarters; (4) clean wallows; (5) movable farrowing houses; (6) rotation of pastures and lots; (5) special treatments for prevention of diseases and parasites.

Controlling Round Worms.—The common intestinal round worms, which are one of the chief causes of death and lack of thrift in young pigs, can for the most part be controlled by proper sanitary measures. The eggs of the round worms, which are microscopic in size, are in great abundance in old hog lots. When pigs are given access to premises which have previously been used, these eggs are picked up and infection results. Upon reaching the intestines the eggs hatch into small grubs, which burrow through the intestinal walls into the blood streams, where they are carried to the lungs. If many of the young worms invade the lungs serious damage results. The pigs often show symptoms known as thumps, and severe infestation may cause pneumonia. Later the worms return to the intestines by being coughed up and swallowed. The worms grow to maturity in the lower part of the digestive tract, sapping the vitality of the pigs and producing millions of eggs which infect others.

Sanitation for the Sow and Litter.—The round worm eggs are very resistant to all kinds of disinfectants. In order to rid the farrowing quarters of worm eggs, the quarters should be scrubbed with boiling water and lye. A pound of lye should be used with each 30 gallons of water. The sow should be washed carefully with soap and water before she is placed in the farrowing pen. After farrowing, the sow and litter should be confined to the farrowing quarters until they are hauled to a clean pasture. A clean pasture is a field on which there have been no hogs for at least a year. If the pigs are kept on the clean pasture until they are three or four months old, no serious harm results from moving them back to the old hog lots. At this time they are old and large enough so that they are not seriously affected even though they are exposed.

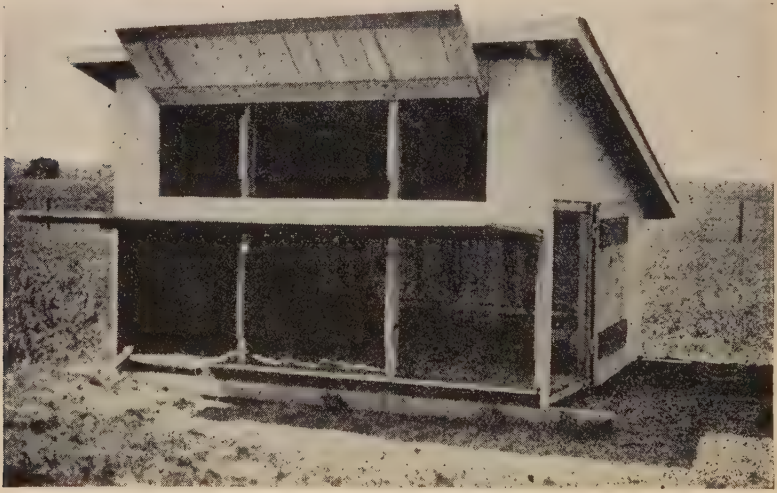


FIG. 132.—Improved farrowing house, strongly built, for individual sow and litter. Note the floor and rimmers. A house so open can be easily kept free from disease.

Using Drugs.—When the four simple steps listed above are carefully followed, round-worm infestation is reduced to a minimum. However, in case there is a slip-up in the sanitation system and infestation occurs, a worm expeller may be given. Santonin and oil of chenopodium are two drugs that have been used with good results. Feed should be withheld twenty-four hours before the worm remedy is administered, and in all cases individual dosage should be used.

Diseases.—The germs causing such diseases as sore mouth, bull nose, and nicrotic enteritis live over from year to year in old hog quarters. The clean-up measures employed in the sanitation system will go a long way toward controlling these diseases.

Hog Cholera.—(U. S. Farmers' Bulletin 834.) Hog cholera is a highly contagious disease of swine which causes many millions of dollars loss annually. All hogs of the same herd are not affected alike, nor at the same time. Some animals die quickly, others may be sick for weeks or months.

Symptoms of Hog Cholera.—Affected individuals usually show a loss of appetite at first and refuse to eat. The sick pigs will remain in the nest and when they are driven out their backs are arched and they appear cold and shiver. The rest of the herd oftentimes remains apparently well for several days, before the symptoms begin to appear in them. As the disease progresses, the sick hogs become gaunt or tucked up in the flank and have a weak, staggering gait, the weakness being most marked in the hindquarters.

When the lungs are affected there is a noticeable cough particularly when the hogs are disturbed. The eyes usually are inflamed and show a whitish discharge which may cause the lids to stick together.

Constipation is commonly found in the early stages and is generally followed by diarrhœa. As the disease reaches its height, red or purplish blotches are likely to appear on the skin of the ears, of the belly, and of the inner surfaces of the legs.

Making Post-Mortem for Cholera.—As some of the symptoms of cholera may be present in other diseases, it is difficult to determine positively that cholera is present unless some of the dead animals are cut open and examined for positive symptoms of cholera. The examination therefore should be done by a trained veterinarian; or see U. S. Farmers' Bulletin 834.

The Simultaneous Method.—Animals can be rendered temporarily immune to this disease by treatment with hog cholera serum. Permanent immunity, however, can only be obtained through the use of the simultaneous method of vaccination, using both virus and serum. This can be done before the pigs are weaned, thus bringing about a saving in cost of materials. Under these conditions this practice should be made a part of the swine-growing operations. U. S. Farmers' Bulletin 834 gives details for this treatment.

Lice.—An effective way of thoroughly eradicating lice from swine is the use of dips. Many farmers use crude oil for this purpose. To destroy lice it is necessary that the herd be treated two or more times, as the lice eggs are not destroyed by the first treatment. A cresol compound may be used as a dip by mixing one part to one hundred parts of water. If cresol is used as a spray it should be used in the proportion of three parts to one hundred parts of water. Ordinary crude petroleum is effective but some forms of it may injure the skin. A rubbing post provided with burlap saturated in oil will do much good but other methods are needed to supplement it. The hog wallow may be covered with a scum of crude oil and the hogs will naturally keep themselves well oiled.

Another good plan is to feed the hogs with shelled corn or other grain and while they are bunched together eating, sprinkle them with oil from a garden sprinkler until all are well sprinkled. The oil will tend to run down the sides and wet the entire body. The sleeping quarters must be cleaned and disinfected to rid the hogs of lice successfully.

Mange in mild cases may be controlled by the same treatment, but frequently a stronger dip is needed. A solution of lime-sulfur is well adapted to this purpose.

Job 7. Managing the Sow and Litter

Conditions Usually Found.—(1) More than one-third of the pigs die before weaning. A large percentage of these die at farrowing time. (2) Many pigs could be saved by care and proper feeding of the sow.

Aims.—How to save and raise the young litter should be well understood.

Problems for Study and Discussion.—(1) Give number of good rations for the pregnant sow and tell how you would change them previous to farrowing.

2. List the common hog feeds according to bulk.
3. Arrange a feeding schedule for the sow after farrowing. Give the amounts and kinds of feeds for each day for the first ten days.
4. What feeds should be used in the pig creep?
5. What methods may be used for warming the farrowing house in cold weather?
6. When and how should pigs be weaned?
7. What harm may result from not removing needle teeth from the mouths of pigs?
8. Describe the structure of a good farrowing pen.
9. Debate farrowing in warm weather vs. farrowing in cold weather.
10. Debate permanent houses vs. portable houses for farrowing.
11. Tell how to build a pig creep. Give its uses.

Activities.—(1) Make a collection of feed samples for swine and label each for the laboratory. (2) Practise removing needle teeth from the mouths of young pigs. (3) Practise warming pigs that are chilled at farrowing time. (4) Make a trial of two lots of pigs, with and without a pig creep. (5) Practise castrating pigs.

Before Farrowing.—As the normal gestation period is about 114 days, the pregnant sow should be separated from the rest of the herd on about the 110th day. At this time, she should be washed as prescribed in the sanitation system and moved to the farrowing pen. The farrowing pen should be fitted with guard rails and should contain a small amount of fine bedding. A large quantity is not desirable because of the danger of pigs getting caught under it, and either crushed by the sow or kept away from her until they become chilled.

As the sow approaches farrowing her feed should be watched carefully. The sow's digestive tract should be rather loose than constipated. Usually no change need be made until she is moved to the farrowing quarters. At this time the ration should be made less concentrated by substituting bulky feeds in place of the concentrated ones. (Fig. 133).

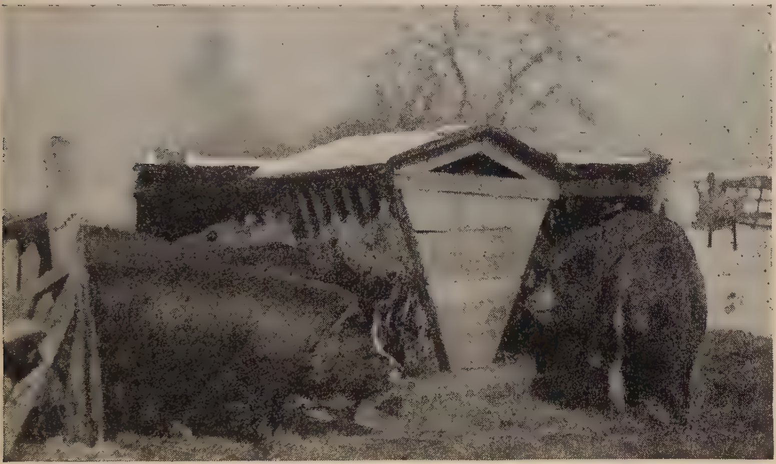


Fig. 133.—An outdoor rack may be filled with alfalfa hay for brood sows. (C. H. Rankin.)

Feeds high in fiber, such as wheat bran, and ground oats, are good for this purpose. Where corn is used as a large part of the ration, it is a good plan to replace half of it with an equal volume of wheat bran, or oats. This change in the ration will do much toward preventing the sow from being constipated at farrowing time. The addition of a quarter of a pound of linseed meal per day, which produces a laxative effect, will help in this connection.

At Farrowing Time.—When the sow farrows, the attendant should be on hand to help in case help is needed. If the sow has no trouble in farrowing she should not be disturbed.

It is a good plan to remove the pigs from the farrowing pen as they are farrowed. The sow is usually in a nervous, feverish condition while farrowing, and may lie on the pigs. The pigs may be removed one by one, and returned to the sow when farrowing is over. In cold weather the pigs should be removed to a warm place, dried and warmed before they are returned to the sow. A splendid way to handle the pigs is to place them in a half barrel which contains a few hot bricks or a jug filled with hot water, over which is spread a small quantity of straw. In case individual houses are being used, it is better to have the barrel at the house rather than to carry the pigs a distance through the cold air.

Feeding the Sow after Farrowing.—The sow needs very little feed for a few days after farrowing. For the first twenty-four hours a small amount of water to drink is all that is needed. The second day it is a good plan to feed a small quantity of ground feed in the form of slop. About a pound a day is enough for this first feed. On the third day this amount may be doubled and on the fourth day a small amount of corn added. The ration may be gradually increased so that the sow will be on full feed at the end of seven or eight days.

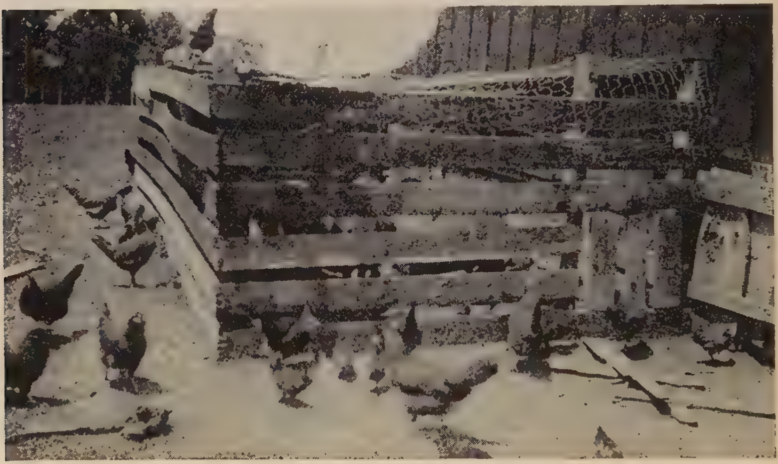


Fig. 134.—A pig creep covered with poultry wire. A trap door keeps out chickens. (Kentucky Station.)

The ration, in order to be suitable for a sow suckling a litter, should be high in protein and mineral. Corn may be used to good advantage but must be well supplemented with such feeds as tankage and skim-milk. There is also the necessity of supplying vitamins. In summer this can best be done by feeding on pasture. Legume forage should be used whenever possible, as it furnishes valuable protein and mineral in addition to vitamins. In dry-lot feeding good quality legume hay should be fed.

This may be ground and mixed with the protein supplement or fed in a rack.

When pasture is used tankage alone or a mixture of tankage and linseed meal may be fed to supply protein and mineral matter. About half as much protein supplement is needed on pasture as with dry-lot feeding.

The Pig Creep.—When about three weeks old pigs begin to eat. This should be encouraged by providing a special pen where feed is available. This is called a pig creep. As pigs like to crack corn this is one of the best feeds to provide. Shelled corn seems to be a little more palatable than ground corn. A mixture of ground corn, wheat middlings, and finely ground oats is relished by young pigs. As young pigs need an abundance of protein and mineral it is a good plan to furnish skim-milk or a mixture of tankage and linseed meal in the form of slop as soon as they will drink.

Making a Pig Creep.—The creep in which to feed the young pigs should be located close by. The entrance should be low or narrow so the dams cannot pass through. Covering the pen will help to keep out chickens. (Fig. 134). The entrance can be equipped with a trap door which the pigs can open without admitting poultry. A burlap bag will serve for this purpose. If the sow and litter are in a colony house in a pasture or field, an extra pen should be built for the pig creep.

Weaning.—Pigs should be weaned at ten or twelve weeks of age. If the pigs are properly fed from the time they begin to eat they will gradually wean themselves without any bad effects on the sow or the pigs and without retarding their gains. This allows them to be weaned entirely from the mother as young as eight weeks, particularly if dairy products such as buttermilk or skim-milk and good pastures are provided.

Castration.—Male pigs that are not to be kept for breeding purposes should be castrated when from two weeks to two months old. Remove them to a pen some distance from their dams and the rest of the litter for this operation. Wash the hands before beginning the operation and use a clean sharp knife. A beginner should learn from an experienced operator before attempting it. Two persons should work together, one to hold the pig on his side and hold the upper hind leg forward and tight against the body while the other person performs the cuts and applies a disinfectant. A satisfactory disinfectant for this purpose is some standard dip. There is usually little danger from the operation if sanitary methods are used.

Job 8. Growing Pasture Crops for Swine

Conditions Usually Found.—Too many farmers fail to plan definite rotations of forage crops for swine. This is one of the important factors in successful swine raising.

Aims.—Swine growers should realize the importance of pastures for swine. They should know how to plan, manage and use these.

Problems for Study and Discussion.—(1) What rotations for hog pastures are common in your neighborhood?

2. Which of these rotations are best from the standpoint of furnishing good hog pasture?
3. Under average conditions what time of year may the following crops be pastured: alfalfa, sweet clover, alsike clover, red clover, blue-grass, rye?
4. What other crops are used for hog pasture?
5. What combination of crops would you use in order to have the best possible pasture for each month of the growing season?
6. List the different local pasture crops for hogs according to their value.
7. Which of these crops do you consider best for your conditions?
8. Plan a series of pastures to cover as much of the year as possible.
9. Find from breeders their ratios of acreage to number of swine pastured.

Activities.—(1) Draw a plan for several pastures showing the crops to be grown on these during the different seasons of the year. (2) Make a collection of the good specimens of each of the crops suitable for swine pastures. Preserve these for the laboratory.

Forage for Swine.—Close students of livestock husbandry and especially successful pork producers are strong advocates of pastures and forage crops for hogs. As a matter of fact the use of forage where large numbers of hogs are kept on one farm is considered more of a necessity each year, so far as the profitableness of the enterprise is concerned.

A Succession of Crops.—On all well-regulated farms the question of major rotation of crops is always given careful consideration. Furthermore, practically every farmer realizes to some degree the advantages of following some system of crop rotation. In a similar way the question of minor rotation or the growing of various pasture and forage crops for use in pork production should be given careful thought by every farmer who is engaged in raising hogs.

The practice of providing only small dry lots for pigs or turning them in the horse pasture is too common. In place of this system, a succession of forage crops should be grown so the animals can have succulent feed during the entire summer and as far as possible through the fall months.

While pigs cannot consume as large amounts of bulky feeds as horses or cattle, there is considerable saving of feed through the use of forage. This is especially true in the use of purchased feeds which forage may replace.

The effect upon the vigor and health of the animals is a factor not to be overlooked, and this alone should be sufficient to engage the attention of hog raisers. The grasses and legumes used provide vitamins as well as minerals which are lacking in many dry-lot rations.

The elimination of parasites, such as lice and intestinal worms, is more simple with pigs on pasture. The growing crops also tend to keep down certain infectious diseases. All of these factors are important and should be considered in handling pigs through the pasture season.

Reasons for Pasturing Swine.—A few important reasons why pigs should be fed on pasture are: (1) Pigs make faster gains. (2) More gain for a given amount of feed. (3) Green feed stimulates the appetite. (4) Valuable proteins, minerals, and vitamins are furnished. (5) Pigs are more healthy and free from worms.

Forage crops vary greatly in a large number of characteristics which influence their value as hog pasture. A few of the things looked for in the crop for hog pasture are (1) palatability; (2) succulence; (3) legume feed; (4) pasture for a long grazing season; (5) endurance of tramping and grazing; (6) reasonable cost and ease of seeding; (7) adaptation tó the rotation.

FIG. 135.—Pigs in clover. Their thrifty appearance proves how well the pasture balances their grain ration. (J. C. Allen.)

Sweet Clover.—This legume holds an important place in the rotation being practised on many corn-belt farms and consequently is being used extensively for hog pasture. With a four-year rotation of corn, corn, oats or barley, and clover, the sweet clover does splendidly for the clean field in the sanitation system. It has many other points in its favor. It is a legume which can be seeded easily and cheaply and will endure a great deal of tramping and grazing. Sweet clover is quite succulent in the fall of the first year's growth and in the spring of the second year's growth. However, during the late summer and fall of the second year it gets coarse and woody and at this time is of very little value as pasture.

Red and alsike clover are well adapted to the rotation and make splendid hog pasture. (Figs. 135 and 136). These crops are more palatable than sweet clover and furnish much better pasture during the summer months. Red and alsike clover, however, will not stand heavy pasturing during the fall of the first year's seeding nor can they be pastured early in the spring.

Fig. 136.—This young swine grower found clover a good pasture crop.

Alfalfa, although not well adapted to the average rotation, is without a rival from the standpoint of furnishing valuable forage for hogs.

Fig. 137.—Sow and litter on alfalfa field.

(Fig. 137). It cannot be pastured quite as early in the spring as sweet clover but furnishes a palatable, succulent, nutritive feed all through the summer and late into the fall. A plan that has been used successfully on some farms is to grow both sweet clover and alfalfa. The pigs are started on sweet clover and later changed to the alfalfa field. In some cases the alfalfa is a permanent pasture and is used for a number of years. The pigs using it should be old enough so that they will not be injured by round-worm infestation.

Rape.—In spite of the fact that rape does not have a long grazing season and is not a legume, it is rated very highly as a forage crop. For the time it can be used it will produce as good results as alfalfa. Rape is especially well adapted for small lots where a temporary pasture is desired. Rape is often seeded in combination with oats. This mixture is ready to pasture about the time the oats start to send up heads. The rape starts growing rather slowly, but is ready for the pigs by the time the oats are eaten off.

Blue-grass, although not a legume nor as high in nutritive value as some of the other pasture crops, is well adapted for late fall and early

CROP	SEED PER ACRE	TIME TO PLANT	METHOD OF PLANTING	READY FOR FORAGE	LENGTH OF GRAZING PERIOD
Alfalfa	12 to 15 lbs.	Apr. 1–15 Aug. 1–15	Drill or broadcast	4– 6 mos.	5– 6 mos.
Red Clover. (With oats or barley)	10 to 12 lbs.	March and Apr.	Drill or broadcast	3– 4 mos.	4– 5 mos.
Red Clover. (With winter wheat)	10 to 12 lbs.	February	Drill or broadcast	3– 4 mos.	4– 5 mos.
Sweet Clover	10 to 15 lbs.	April	Drill or broadcast	2– 3 mos.	4– 5 mos.
Oats	1 to 2 bu.	March	Drill or broadcast	6– 8 weeks	4– 6 weeks
Oats Sweet Clover	1 bu. 8 to 10 lbs.	Mch. 15 to Apr. 15	Broadcast	8–10 weeks	4– 5 mos.
Oats Rape	½ bu. 3 to 4 lbs.	March and April	Broadcast	6– 8 weeks	5– 8 weeks
Rape	6 to 7 lbs.	April 1 to July 1	Drill or broadcast	8–10 weeks	2– 4 mos.
Rye	1 to 1½ bu.	Aug. 15 to Sept. 20	Drill or broadcast	6– 8 weeks	10–12 weeks
Soybeans (cultivated)	30 lbs.	May 1 to June 1	Drill in 28-in. rows	3– 4 mos.	4– 5 weeks
Soybeans	60–75 lbs.	May 15 to June 1	Drilled	3– 4 mos.	5– 6 weeks
Corn Soybeans	7–10 lbs. 4– 6 lbs.	May 1 to June 15	In rows together	12–14 weeks	3– 6 weeks

spring pasturing. At these times it will withstand grazing when the clovers and alfalfa would be killed out. During the hot summer months blue-grass makes very little growth and is of little value for pasture.

Rye, when seeded in August or early September, makes splendid pasture in the late fall and early spring. It is often used in the spring before the clovers and alfalfa are ready.

Soybeans may furnish good forage for swine in the latter part of summer and until the time of killing frosts. They are often grown in the rows with corn or sorghum or may be sown broadcast with other forage crops. **Cowpeas** are used in like manner for swine in central and southern latitudes.

A suggested table of forage crops for hogs may prove useful in working out a system of supplying feed of this kind throughout the season. The forage crops are most palatable and have the greatest feeding value while young.

Job 9. Feeding Swine for Market

Conditions Usually Found.—Some farmers get their swine on the market at six months of age weighing 200 to 225 pounds each, while others fail to make their pigs weigh more than half that amount at this age. In Illinois 359 official ton litters have been produced, i.e., individual litters that weighed a ton or more at 180 days of age. The heaviest litter weighed over 5000 pounds.

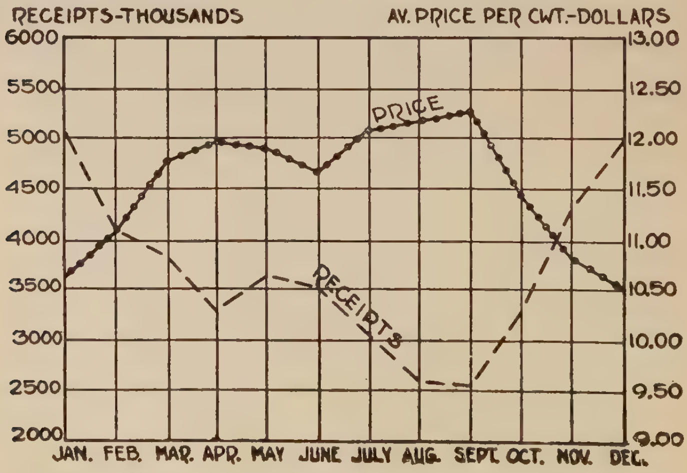


Fig. 138.—Average receipts at public stock yards (15) and average hog prices at Chicago by months, 1915–1924. Feeding should be timed to try to meet high market prices. (Nebraska Station.)

Aims.—Feeders should know how to force pigs for market safely, rapidly and economically.

Problems for Study and Discussion.—(1) What time of the year are the spring pigs in your locality marketed?

2. What is a good weight for a four-months-old pig? For a six-months-old pig?
3. Define nutritive ratio.
4. Why is a mixture of corn and soybeans not a complete ration?
5. Give a number of rations which require additional mineral matter.
6. Name local farmers who full-feed their pigs from the time they are weaned and give results.
7. What are the advantages in using a self-feeder in fattening hogs?
8. How many local farmers use self-feeders? For what ages of swine?

Activities.—(1) Make a chart showing the different supplements for corn in fattening hogs, with comparative values. (2) Make a chart showing the materials suitable for a mineral mixture for swine. (3) Obtain data from some farmer who has weighed his pigs during the feeding season, or get the data from a bulletin and make a chart of these data, as a guide in feeding swine. (Fig. 138).

Fig. 139.—Duroc-Jersey ton litter, fed 18 days, uniform and of good breed type. Permanent hoghouse in the background.

Full-Feeding.—Usually the most profit is made by full-feeding pigs from the time they will first eat. (Fig. 139). With this method of feeding an earlier and higher market is available; less feed is needed to make a hundred pounds of pork; and the shorter feeding period reduces the overhead cost and the danger from loss.

Spring pigs are often fed slowly through the summer in order to have them of proper size for following cattle or for hogging down corn in the fall (Fig. 140). This is not an economical practice, as pigs are produced more cheaply by having them farrowed later and fed more rapidly.

Pigs Grow and Fatten.—When pigs are full-fed from the time they will first eat, the ration must be complete both for fattening and for growth. Cereal grains such as corn, oats, and wheat are especially high in material for producing fat. There must also be in the ration such feeds as tankage and skim-milk which furnish the material for muscle building or growth. Therefore the ration must have the proper proportion of carbohydrates or fat for producing fat, and protein for growth or muscle building. Unless these substances are in proper balance the gain will be neither rapid nor economical.

Nutritive Ratio.—The relationship of growth material to fattening material, which is known as the nutritive ratio, varies with the size of the pig. With an increase in size there is a decrease in the proportion of protein needed. The following table gives the nutritive ratios for pigs of different sizes.

FIG. 140.—Hogging-off corn saves the labor of gathering corn and feeding. It requires more labor in watering and may waste some corn. (F. H. Russell.)

Weight of pig	Nutritive Ratio
50–100 lbs.	1 to 5.1
100–150 lbs.	1 to 5.9
150–up lbs.	1 tc 6.9

The inefficiency of corn alone is easily understood when we consider that the nutritive ration of No. 2 corn is 1 to 10.4.

Farm Grains Deficient in Mineral.—When pigs are fed a ration made up largely of corn or other home-grown feeds as oats, wheat, and barley, they often make slow gains and sometimes become lame and crampy. This condition may be due to the lack of mineral, which is the substance used in bone building. The elements most commonly found lacking in ordinary farm rations are sodium chloride, calcium, and phosphorus. Sodium chloride is easily supplied by feeding common salt. Calcium and phosphorus are found in large amounts in tankage, skim-milk, and legume pasture. The minerals may also be supplied by feeding a simple mineral mixture such as 2 parts ground limestone, 2 parts steamed bone meal, and 1 part common salt.

Vitamins.—Even though pigs are fed a ration balanced as far as protein and mineral is concerned, stunted growth may result when dry-lot feeding is practised. The proper proportion of corn and tankage is an example of ration complete except for the vitamin requirements. The absence of vitamins can be detected only by experimental feeding and not by the analysis of feeds. White and yellow corn appear to be of the same composition; yet yellow corn contains a vitamin that is lacking in white corn. This substance is known as vitamin A, and is of practical importance in dry-lot feeding.

Even though yellow corn and tankage are used, another vitamin deficiency is found. The stunted growth and lameness caused by this incomplete ration is thought to be caused by the absence of a substance known as vitamin D. Both vitamins A and D are found in abundance in cod-liver oil and alfalfa hay. Under practical conditions it appears that in dry-lot feeding the vitamin requirements can best be met by grinding alfalfa hay and mixing with other feeds or feeding good quality alfalfa hay in a rack. All kinds of growing crops contain an abundance of both vitamins; consequently the problem is not important except under strictly dry-lot conditions.

The part that direct sunlight plays in nutrition is not definitely determined, although it is known that vitamin deficiencies do not seem to appear as readily when the pigs are exposed to the direct rays of the sun.

Corn as a Hog Feed.—Corn, because of its abundance on the farm, palatability, and high nutritive value, is prized very highly as a hog feed. It must, however, be supplemented with feeds that increase the protein, mineral, and vitamin content of the ration. Tankage and skim-milk may be used to furnish protein and mineral, but do not furnish the necessary vitamins. This deficiency may be made up by giving the pigs access to legume pasture or furnishing good alfalfa hay. Although corn, tankage or skim-milk, and legume pasture or alfalfa hay make a very complete ration, experimental work has demonstrated that the addition of linseed meal makes a cheaper and more efficient ration.

Below is given a ration that gives good results in dry-lot feeding. It should be noticed that the proportions of the different feeds change with a change in weight of the pigs.

Weight of Pigs	Corn	Tankage	Linseed Meal	Alfalfa Meal
50–100 lbs................	80	11	5	5
100–150 lbs................	84	7	5	4
150–up lbs................	88.5	4.5	4	3

Pigs should have access to all the corn they can eat and the other feeds mixed together and self-fed. These feeds may be mixed as follows: tankage, 2 parts; linseed meal, 1 part; alfalfa meal, 1 part.

Another good dry-lot ration, using skim-milk in place of tankage and alfalfa hay in place of alfalfa meal, is as follows: corn, self-fed; alfalfa hay, self-fed in a rack; and skim-milk or buttermilk, fed according to the weight of the pigs.

Weight of Pigs
50–100 lbs. with 2.5 lbs. skim-milk to each pound of corn
100–150 lbs. with 2 lbs. skim-milk to each pound of corn
200 lbs. up with 1 lb. skim-milk to each pound of corn

When feeding on good legume pasture, the alfalfa may be omitted and the tankage or skim-milk cut in half. Tankage may be self-fed on pasture, although better results are secured by mixing 2 parts tankage and 1 part linseed meal.

Other Home-grown Feeds.—Ground wheat, rye, or barley may be substituted for a part of the corn in the ration. Compared with corn, they are about 90 per cent as valuable, pound for pound. A slightly smaller amount of protein supplement is required when wheat, rye, or barley makes a part of the ration in place of corn as the sole grain.

Oats may be used to a limited extent in the swine ration. However, because of its high crude fiber content, decreased gains result if it is used to the extent of more than 25 per cent of the ration.

Soybeans may be used as both a substitute and a supplement for corn. Two pounds of soybeans are required to furnish as much protein as is furnished by one pound of tankage. When soybeans are fed with corn, a mineral mixture should be included in the ration.

Self-feeders are used more and more in feeding swine. This is due to the fact that they are constructed at small expense and save considerable labor in feeding. (Fig. 116 and 133). Pigs fed on self-feeders consume more feed than when fed by hand, and therefore make greater daily gains.

Timing the Feeding Job.—Prices of hogs of the same grade vary widely during each year. The feeder should try to meet the high price periods in the calendar. He can do this to some extent by timing the pasture period and the finishing period with each lot of swine. A study of price curves for the preceding years will form a guide for making suitable feeding plans. (Figs. 138 and 141). The plans followed in the ton-litter methods of forcing, or the slower feeding plans should be contrasted and adapted to suit the best date for marketing.

Job 10. Showing and Selling Breeding Stock

Conditions Usually Found.—(1) Many breeders show swine at fairs. (2) Most exhibitors are skilful in preparing and showing stock. (3) Sales of pure-bred swine are made at public and private sales. (4) Breeders use farm papers and other means of advertising.

Aims.—(1) Methods of preparing swine for show at fairs and auction sales should be understood. (2) Methods of advertising, showing, and conducting sales should be known.

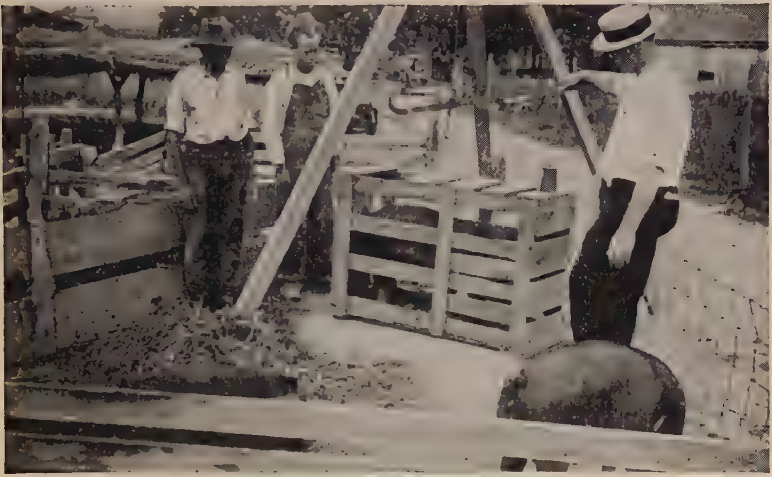


FIG. 141.—Steelyards and tripod used to keep a close check on the methods of feeding. (Kentucky Station.)

FIG. 142.—Bunch of fall shoats developed on alfalfa pasture, now being finished.

Problems for Study and Discussion.—(1) How many club boys or farmers show swine at fairs in your region?

2. Compare the relative merits of pedigree and individuality in advertising pure-bred swine.
3. Ask breeders what advertising value comes from exhibiting swine at state or county fairs.

4. Describe the preparation of swine for show and auction sales.
5. How does washing improve the quality and condition of the hair and skin?
6. Why should swine be kept out of the hot sunshine during the preparation period?
7. How would you trim pigs' feet?
8. Under what conditions should the hair on any part be clipped?
9. Describe the conditions under which swine may be kept clean just before exhibition.
10. What is a hand hurdle? Of what use is it in handling swine? (Fig. 145).
11. What are the dangers of petting swine too much during the preparation for show?
12. Describe how you would show swine before the judge. (Fig. 146).

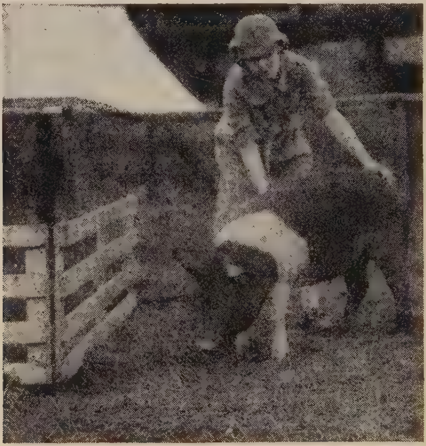


FIG. 143.—One of the Smith sisters showing Hampshire gilt. Illinois State Fair.

13. Debate public auction vs. private sales.
14. Give the steps in preparing a sale catalog.

Activities.—(1) Prepare pigs or other animals for show or for sale. (2) Train such animals to handle well. (Fig. 141). (3) With sale catalogs of other breeders prepare a catalog for yourself or a neighbor.

Preparing for Shows and Sales.—To show well, an animal must be carefully fitted. It is essential that the animals in the show herd be properly conditioned. Careful feeding methods and well-planned rations must be used. Only good individuals, growthy for their ages, with true breed type and quality, should be put in the show herd. A few poor individuals oftentimes mar the appearance of an otherwise attractive herd.

In addition to this the appearance of the animals will be improved by: (1) Washing the skin and coat to make them soft and to cure blemishes and dandruff; (2) grooming to encourage skin secretions and improve appearances; (3) oiling the hair; (4) trimming feet; (5) clipping surplus hair about the ears, on the tail, and perhaps elsewhere; (6) handling and posing the animal to present good effects.

Showing.—Students, club boys, and other breeders must watch the fair program and know when each class of swine is to be called for exhibition and judging. (Figs. 143 and 145). Everything should be ready at the right moment. The final grooming, brushing with oil and rubbing with a cloth should be over so that the animals will show lustre and attract attention. A rest period preceding the entrance to the show ring is very helpful. The exhibitor himself should look clean, neat, and attractive.

FIG. 144.—Smith sisters, Hampshire Pig Club members, Illinois State Fair. Driving sticks and ribbons are clearly shown.

Right training in handling will be manifest in showing, for the driving must be prompt but not too rapid. (Figs. 143, 144, 145, 146). A hurdle is important in handling swine at this time, but if only one individual is shown at a time, the hurdle may be laid aside in the arena. Be prepared for emergencies of all kinds. Guard against fighting of animals and be ready to brush the coat if the animal roughens it up. The right position of the animal with respect to feet, arch of back, and other elements of pose should be watched closely. Good showing is often half the battle. Skilful exhibitors know this. Avoid getting between the judge and the animal being shown. Keep the animal at a good distance but not too far away from the judge. (Fig. 146). Do not allow other animals to

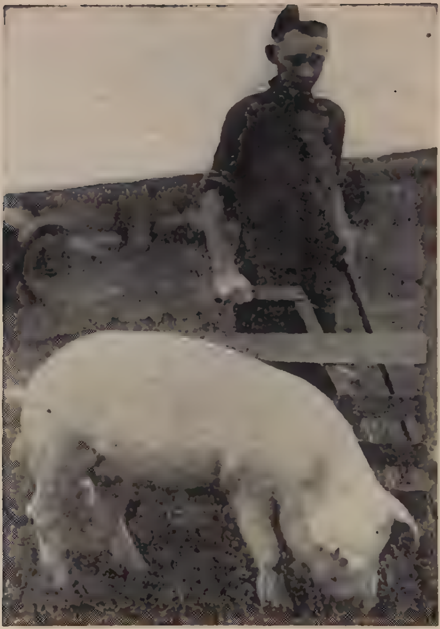


FIG. 145.—This young swine grower won $33.00 in cash showing his Chester White pig at fairs.

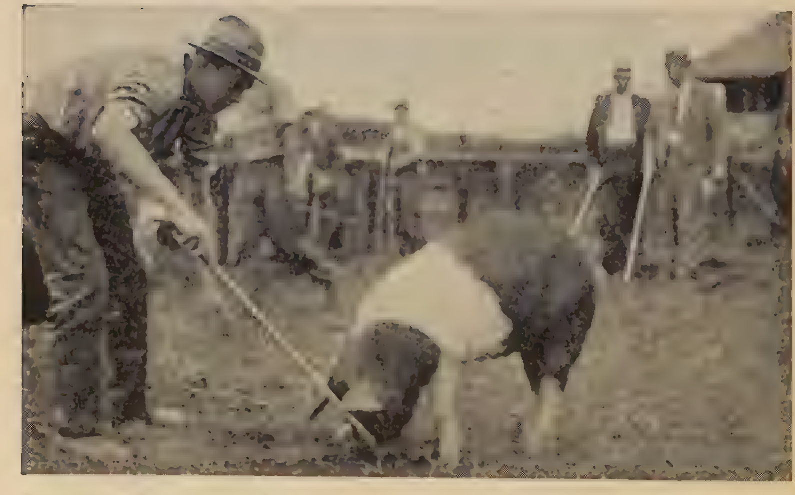


FIG. 146.—This young man is endeavoring to show his Hampshire gilt to good advantage before the judges. He believes that showing pays.

interfere with the judges' view of yours. Keep animals at attention until the very last moment. Practice in showing will help you win. Be a cheerful loser and learn as you go along.

Importance of Advertising.—Breeders of pure-bred swine have surplus animals each year which should be sold at prices above those for market swine. The best advertising will be secured through (1) using reliable farm journals; (2) reading matter in local papers regarding the breeding, winnings, and sales of individuals of the herd; (3) showing swine at fairs and winning premiums; (4) neatly printed placards and business cards.

Selling Pure-breds Privately.—When pure-bred swine have been advertised in farm journals, the owner should have pedigree sheets showing breeding and ancestry of each animal ready to show prospective buyers. Copies may be written long hand, typed, mimeographed, or printed to send in the mail. Good snapshot pictures will help greatly. The number of pigs in the litter should be stated. Always state the weight, age, and condition of the individuals and make a full description if a picture is not supplied.

Private sales are often made at fairs. Exhibitors of swine are allowed to take a few animals to the fair for sale purposes. The owner should be ready to give information about his herd in printed form to each inquirer at the fair.

Auction Sales of Swine.—One or a group of breeders may conduct auction sales each year. If this plan is followed be sure that the animals intended for sale are worthy and that buyers will not be disappointed in them. Confidence of buyers must be courted in every way. Attractive catalogs and pictures will help. Advertising of sales is very important. Breeders use circulars, fasten up placards and posters, and use farm journals. Ask the breed association to send a field agent to assist in making a catalog, advertising, and planning for the sale.

Pure-breds are always bought for breeding purposes at such a sale. Their breeding must be guaranteed or adjustments made. Statements regarding the breeding, produce of dams and granddams, age and condition of individuals should be made in the catalog as well as orally at the sale. A good auctioneer is essential to success. The terms of the sale should be as liberal as possible.

Job 11. Marketing Swine

Conditions Usually Found.—(1) Farmers follow different methods of marketing their swine. (2) Coöperative shipping associations are increasing in numbers.

Aims.—Close study should be given to marketing problems.

Problems for Study and Discussion.—(1) When are most of the hogs marketed in your section?

2. When are the high and low market prices?
3. Why is it wise to full-feed hogs and place them on the market early?
4. Get opinions of farmers regarding coöperative marketing of swine.
5. How does a coöperative shipping association function?
6. How should a car be prepared for shipping hogs to market?
7. How are hogs marked when several owners ship in the same car?
8. Why should each animal be well graded as to finish and weight?
9. Who should do this grading for a coöperative shipment?

Activities.—(1) Write up an agreement form and rules for a coöperative shipping association. (2) Prepare a car for shipping hogs to market. (3) Mark swine which are to be loaded in a car belonging to several farmers. (4) Help load cars for market.

High and Low Prices.—There is no set rule that can be followed in determining when hogs should be marketed. A study of the hog market for a number of years shows quite consistently high and low prices during certain months. Over a period of years the September price averages $2.00 a hundred higher than the December price. Another high peak is reached in April, although not as pronounced as the one in the early fall. There is also a low market in the late spring or early summer, which usually occurs about the month of June.

Fig. 147.—Three ton litters, over 6000 pounds of pork, produced in 180 days; ready for shipment to market.

Conditions may cause the peaks and low points to vary over narrow limits from year to year, but the general seasonal trends can be relied upon. The fall market can be predicted with more certainty than the spring market. It is therefore a good plan to sell spring pigs as soon as possible in order to avoid the declining market which usually reaches the low point in December or January.

Shipping Hogs.—The bulk of the hogs are transported to market on railroads, although trucking is becoming more common each year, particularly in regions near the markets.

Assuming that hogs are to be shipped by rail, the producer has three possible ways of marketing them. (Fig. 147). The owner may ship his own hogs, may sell them to a local buyer, or in most localities may ship them through a coöperative shipping association.

Coöperative Marketing.—For the average producer the coöperative organization provides a good method of marketing his hogs, throughout the year. The shipping-association manager takes charge of the hogs upon delivery to the local shipping yards and the owner is relieved of all further details of marketing. By this system of marketing the owner gets the actual selling price of the stock minus the shipping costs.

Ordering the Car.—In case the owner is shipping his own stock it is necessary to order a car through the local agent a few days ahead of time. It is a good plan to have a definite understanding with the railroad agent specifying the size of the car and the time it is to be delivered.

Preparing Hogs for Shipment.—Hogs should not be fed in the car nor for a few hours before loading. If feed is withheld they stand the trip with less loss in shrinkage and death and make a good fill when fed on the market. Hogs should reach the local shipping yards in time to have a few hours' rest before being loaded, and should be handled as carefully as possible.

Bedding the Cars.—The car should be supplied with material for bedding. For cool weather straw or sawdust answers the purpose very well. For hot weather, sand, which is thoroughly wet down before the hogs are loaded, is ideal. The wet sand keeps the car cool and greatly reduces the chance of losses and shrinkage. Another precaution which is often observed in summer is to hang from the top of the car two or three sacks containing ice.

Handling the Hogs on the Central Market.—Upon reaching the market the hogs are handled by a number of organizations. The stock-yards company, which owns the chutes, pens and other facilities on the market, unloads the hogs and drives them to the pens of the commission firms to which the shipment is consigned. After being watered and fed the hogs are sorted and sold by the commission men. The commission firm is responsible for the shipment from the time it reaches their pens until it goes over the scales to the buyer.

A terminal livestock market may be defined as a place where any quantity or kind of livestock may be sold at a cash price. In order to take care of the different kinds of hogs coming on the market there are a number of possible outlets for them. The majority are sold to packers for local slaughter. Some are reshipped to other markets or to packing companies in other centers. A small number are sold as feeders and sent back to the country for additional feeding. A still smaller number go into the hands of dealers and speculators to sort and resell.

Job 12. Butchering and Curing Pork

Conditions Usually Found.—(1) Many farmers butcher enough hogs in cold weather to supply themselves with pork for the year. (2) Smoking and other forms of curing are common in many regions. (3) Fresh and cured pork are often sold by farmers in local markets.

Aims.—Methods of killing, butchering, and curing meat should be understood by young farmers.

Problems for Study and Discussion.—(1) What tools and equipment would you want for killing and butchering swine?

2. Describe different plans for scalding.
3. What are the best conditions of swine for killing?
4. What objectionable conditions should be avoided?
5. Tell how to kill and bleed a hog.
6. Give directions for scalding and scraping the carcass.
7. How should the viscera be removed?
8. Tell how to save the lard parts for rendering.
9. Outline a good plan for cutting up a carcass.
10. What parts are usually cured and what used fresh?
11. Give directions for dry-salt curing.
12. Tell how you would brine-cure pork.
13. Outline a plan for curing with smoke.

Activities.—(1) Assist in the killing and butchering of pork. (2) Carry the curing process through the stages of brining and smoking (3) Make fresh sausage by an approved method. U. S. Farmers' Bulletin 1186.

Hogs for Butchering.—Healthy, well-fattened barrows weighing between 200 and 250 pounds are the most satisfactory hogs to slaughter for home use. It is usually better to send very fat animals, boars, stags, old sows, to market rather than butcher them at home. Any animal that shows any signs of disease should be discarded, as some diseases may be transmitted to humans from the meat of diseased hogs. Select those which are gaining in flesh rather than those which are losing. Meat intended for market will find a more ready sale if animals under one year of age are slaughtered. Cuts from medium-sized hogs are more popular than those from old and very large animals.

In preparing hogs for slaughter no feed should be offered them during a period of 24 hours before butchering. By doing this more waste products will be eliminated from the system and the viscera will be easier to remove. Plenty of fresh drinking water should be available and only moderate exercise allowed.

Butchering Equipment.—The equipment needed will consist of a large kettle in which to heat scalding water, a large scalding barrel, a scraping platform, butcher knives, sharpening steel, hog hook, bell-shaped stick scraper, meat saw, and one gambrel stick for each hog to be butchered. If the hogs are large they can be handled more easily with a block and tackle and derrick.

The scalding barrel should be set at a 45 degree angle, with the lower edge of the top slightly above the scraping platform. The barrel must be fastened securely so it will not slip.

Killing and Bleeding.—The hog may be stunned or not before sticking as desired. Stunning with an axe is commonly practised. Shooting with a small rifle may be used. If the bullet penetrates the brain the heart stops beating and the only blood removed is that removed by drainage. When the hog is stuck before the brain is penetrated the heart pumps most of the blood out of the body. If not stunned the hog should be held by the operator astride the body just back of the shoulders and holding the fore legs while his helper sticks and bleeds the hog.

A sticking knife has a long, straight blade with a sharp point. The cut should be made in front of the breast bone at the center line, aiming slightly backward. Avoid cutting the shoulder meat. After inserting the knife six or eight inches, remove it so as to cut the blood vessels in the neck. Cutting the heart retards good bleeding. The hog may now be released, although if a hind leg is raised a few feet from the ground, bleeding will be more thorough.

Removing the Hair.—Scalding is essential to the quick and thorough removal of the hair by scraping. For hogs of moderate size, a barrel at an angle of 45 degrees will hold enough water for scalding. It is well to have a thermometer present as the water should be about 150 degrees F. Boiling hot water poured into the barrel will soon cool to this temperature. Some farmers throw in a shovelful of wood ashes as the lye they contain will help remove the scurf from the skin. Before starting to scald cut the skin below the hocks and loosen the tendons in each hind leg.

The hog may be handled by inserting the hog hook in the lower jaw. Keep the hog moving in the water, sousing it up and down two or three times and then changing ends of the carcass. To scald the front part of the body it will be necessary to hold by the hind legs. Try the hair, and when it can be slipped off with the hands lay the carcass on the platform and scrape rapidly and thoroughly. Clean the head and feet first.

Suspending the Carcass.—After the hair has been removed insert the gambrel stick under the tendons in the hind legs and hang the hog from a suitable support so the head just clears the ground. The final dressing and scraping may take place after suspending the carcass. Rinse the carcass with hot water and scrape clean, then dash cold water on it to remove any loose hair or dirt.

Removing Viscera.—With the carcass hung at a convenient height, place the knife at the midline (Fig. 148), beginning at the top and cutting carefully downward to the head. Be careful not to cut any of the internal organs. As the entrails are loosened they should be caught in a tub or large dishpan. Remove the stomach and gullet along with the intestines. The heart, lungs and windpipe are removed together after cutting the diaphragm. Rinse the inside of the carcass with cold water.

Saving the Lard.—The leaf fat, intestinal fat, and kidney fat should always be saved and rendered by melting at moderate heat to save the lard.

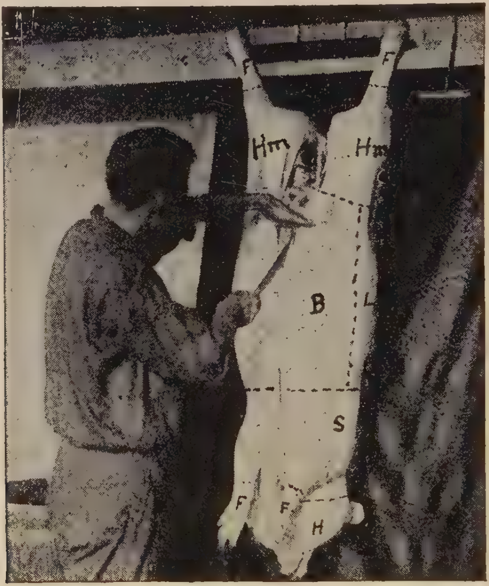


Fig. 148.—Student removing viscera at butchering time. Cuts of meat shown by dotted lines. H, head; F, feet; S, shoulder; L, loin; B, bacon strip; Hm, ham. (New Jersey Station.)

Cutting the Carcass.—After the carcass has cooled over night it should be spread and divided by sawing down the backbone exactly on the midline. The usual method is to remove the head at the atlas joint, cut out the ribs on each side and take out the backbone. The ribs and backbone on most farms are used as fresh meat and often the head, loins, jowls, and feet are not cured but are used during the first part of winter with little, if any, salting. The usual cuts which are salted or brined and smoked are shoulders, middlings or bacons, and hams.

Curing.—Good hardwood barrels are suitable containers for curing pork. Large jars are sometimes used for small cuts. These should be placed in a cool, well ventilated cellar.

Dry curing is perhaps more common than brine curing. In this process the surface of the meat is rubbed with fine salt and allowed to drain for about twelve hours with the flesh side down; then use the following government mixture or other approved recipes.

Dry-Cured Pork.—For each 100 pounds of meat use
8 pounds salt.
2½ pounds molasses or sirup, warmed slightly.
2 ounces saltpeter.
3 ounces black pepper.
2 ounces red pepper.

This mixture when stratified with the layers of meat in the container should cure 10 pound pieces in about 20 days.

Brine Curing.—For each 100 pounds of meat, use the following government formula.

Sweet-Pickle or Brine-Cured Pork.—
9 pounds salt.
2½ pounds sugar or 4 pounds molasses or sirup.
2 ounces of saltpeter.
4½ gallons water.
If the weather is warm, 10 pounds of salt is preferable.

Calculate the time required for this by a ratio of 1 pound to 4 days, 20 pound pieces requiring 80 days. Small pieces cure quickly.

Smoking Meats.—If meat has been brine-cured it should be soaked in clear water before smoking. The dry-cured meats are not so treated. Hang meats so they do not touch each other and are at uniform distances above the smoke fire. Use materials for fuel which will not produce great heat but will give off large quantities of smoke, such as hickory or other hard wood. Avoid intermittent fires. Hold the temperature at about 120 degrees F. or less. Two days will give a satisfactory color and flavor to the meat, but longer curing is often practised. Wrapping hams, shoulders, and sides of bacon in heavy paper or cloth sacks and placing them in a cool cellar usually gives satisfactory results.

Making Sausage.—At butchering time much of the meat should be made up into sausage. There are many trimmings from sides, bacon strips, hams, shoulders, and meat from backbones and spare ribs which may be used either for rendering into lard or making into sausage.

If smoked sausage is desired, casings may be made from the intestines or muslin bags may be used. Small salt sacks may serve this purpose.

For link sausage, a stuffing attachment should be purchased with the meat grinder, or the sausage may be filled by a separate machine. If muslin bags are used, the surface may be coated with paraffin after filling.

A recipe for good pork sausage is to have the meat about two-thirds lean and one-third fat. For seasoning sausage use 1½ to 1¾ pounds of salt, 2 ounces of sage, 1 ounce of nutmeg ground fine, and 4 ounces of fine black pepper, for 100 pounds of meat. It is well to add the seasoning before grinding for the grinding process helps to make the mixing more thorough. Less seasoning is often used for fresh sausage than for smoked sausage.

Job 13. Keeping Swine Records and Accounts

Conditions Usually Found.—Nearly all breeders have some system of marking their individual pigs. Many fail to keep breeding records, cost records, and some fail to register pigs.

Aims.—Students and farmers should adopt some marking system as a means of weeding out their poor producing sows. They should learn how to register pigs and how to keep cost and sales records for swine.

Problems for Study and Discussion.—(1) Make a list of all the hogs on your farm, by classes.

2. Report on method of numbering animals found in your community.
3. Give directions for registering swine for the breed of your choice. When should this work be done?
4. Why should a breeding record be kept?
5. Why should you keep cost records and sales records? (See beef-cattle enterprise for suitable forms.)

Activities.—(1) Practise marking young pigs with an ear punch. (Figs. 149 and 150). (2) Get registration blanks from a breed association and fill these for registering a litter of pure-bred pigs. (3) Draw forms for keeping a labor record and feed record for swine for one year. (See beef enterprise.) (4) Draw another form for keeping records of sales for one year. (5) Fill these records from your own data or from data obtained from a good breeder. (6) Make a breeding record such as is shown in the text.

Breeding records are an absolute necessity for pure-bred herds and are highly desirable for the producer of market hogs. For the pure-bred herd, where more than one boar is in service, the breeding record is depended upon in writing pedigrees and in indicating when each sow is due to farrow.

Breeding Record—Fall 1928

SOW'S NUMBER	SIRE AND DAM	BOAR USED	DATE BRED	DUE TO FARROW

In herds where the animals are not registered, a knowledge of the farrowing date enables the owner to make conditions more favorable for saving the pigs. This is especially true when sows are to farrow in wintry weather.

Previous to the breeding season each sow in the herd should be given identification marks, which may be a metal tag placed in the ear or a notching system. Owners differ as to the amount of information that should be kept on the breeding record. The following form embodies a number of features which are thought by most breeders to be essential.

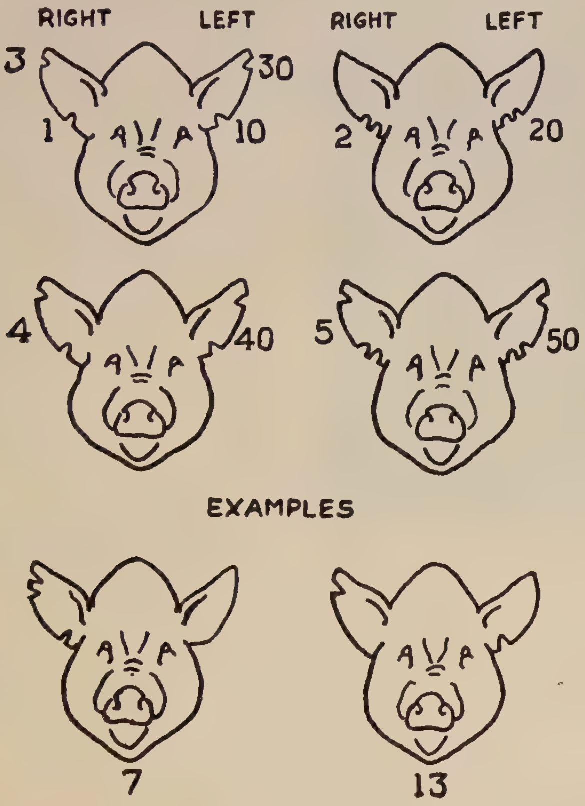


Fig. 149.—Ear notches for marking pigs.

The second column is an aid in guarding against the use of a too closely related sire. By using a gestation table the last column can be easily filled.

Marking the Litter.—When the pigs are a few days old each one should be given a litter mark. If pedigrees are to be written this is absolutely necessary; however, this practice is also gradually being taken up by men who are producing swine for market. Another reason for knowing the ancestry of the pigs is that a record makes it possible to select gilts from sows that are good producers. In this way a good producing strain can be selected which will build up and improve the herd.

The sow is identified by a notch or a series of notches in the ears. There are many systems of marking pigs in use at the present time. The plan shown in the illustrations is very satisfactory. (Figs. 149 and 150). By this system each sow may be given a number by the location of the notches in the ears. Her pigs may be given the same number to identify them until they are used for breeding purposes at which time the number should be changed so as to differ from any already in the herd.

FIG. 150.—Marking ears with a hand punch.

Detailed Method.—The system of numbering illustrated is more simple and useful than many in use. Number 1 is represented by a single notch at the base of the right ear; number 2 by two notches in the same location. Number 3 is represented by a single notch at the tip of the right ear, and number 9 by a single notch in the center of the right ear. The left ear is not used except for numbers larger than 10. Notches representing 10, 30, and 90 occupy the same position on the left ear as 1, 3, and 9 have on the right ear.

Registering Pigs.—With each breed of swine there is one or more record associations. These associations have for their purpose the registering of pure-bred hogs. To be eligible for registry, a pig must have both its sire and dam recorded in the books of a record association.

Registration blanks for recording swine may be obtained from the different record associations (see Appendix). This blank should contain the following information: The name, the sex, the identification marks of the animal, also the number of pigs in the litter, number of each sex raised, the name of the breeder and the following information about the sire and dam of the animal to be registered. Their names, numbers, name of owner, name of breeder, and the dates of their farrowing. The breeder of the animal is the person who owned the dam at the time she was bred.

References to Swine Books.—Day, G. E., Productive Swine Husbandry (Lippincott); Smith, W. W., Pork Production (Macmillan); Smith, W. W., Pig Book for Boys and Girls (Lippincott); Smith, W. W., Elements of Live Stock Judging (Lippincott).

SHEEP ENTERPRISE

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Analysis into Jobs.—The following fifteen jobs include the main operations in the sheep enterprise. References are to numbers of U. S. Farmers' Bulletins. See also *Productive Sheep Husbandry* by Coffey; and *Sheep Production* by Horlacher.

1. Determining the possibilities with sheep. Bul. 840, 929, 1051.
2. Choosing the type and breed of sheep. Bul. 576.
3. Selecting and buying stock for breeding and feeding. Bul. 929, 1051, 1199.
4. Planning barns, shelters and equipment. Bul. 810.
5. Planning rotations and pastures. Bul. 929, 1051, 1181.
6. Feeding the flock. Bul. 929, 1051.
7. Managing at lambing time. Bul. 840.
8. Growing the young stock. Bul. 1134.
9. Controlling diseases and enemies. Bul. 713, 798, 1268, 1330, 1155.
10. Keeping sheep records. Registering stock. Bul. 511, 572, 782, 1182.
11. Improving breeding stock.
12. Shearing and caring for wool.
13. Showing and selling breeding stock.
14. Marketing lambs, sheep, and wool. Bul. 1144.
15. Butchering lambs and sheep. Bul. 1172, 183.

Job 1. Determining the Possibilities with Sheep

Conditions Usually Found.—(1) Some regions are better adapted to the raising of sheep than others. (2) Prices for wool and mutton are usually good. (3) Special phases of the sheep enterprise are worth considering in almost every locality.

Aims.—(1) Students should study their local conditions as to pastures, bad dogs and other predatory animals, parasites, prices, selling conditions, and suitable labor.

Problems for Study and Discussion.—(1) Get the opinions of farmers who own sheep regarding the advisability of raising sheep.

2. Who among them have experienced serious losses from sheep-killing dogs?
3. To what extent have parasites and other enemies been destructive in local flocks?
4. Calculate the cost of equipment for barns, shelters, fences and other equipment on a well-equipped sheep farm.
5. Ask sheep raisers regarding the labor expenses in this enterprise.
6. What are the local crops grown partly or wholly for feeding sheep?
7. See if it is necessary to purchase any feed.
8. Find the prices for the last four or five years for lambs; for mutton sheep; for wool.
9. Consult Census Reports and Yearbooks from the U. S. Department of Agri-

culture and study the trends in sheep production in the United States with respect to (a) total sheep population; (b) regions or states having largest numbers; (c) total wool production and wool production per head; (d) total value and value per head; (e) compare total wool production with total wool consumption.

10. Draw conclusions from the above if possible as to the extent to which the production of mutton and wool has increased or declined in the country. Draw conclusions as to whether it has increased or declined on the per head basis.
11. Compare the sheep production of the United States with the production of beef cattle and of swine.
12. Compare the sheep industry of the United States and Canada with that of the British Isles, Australia, New Zealand, and Argentine as to the production and consumption of mutton and wool. How do you account for the differences you find?

Activities.—(1) Make a table of the prices received for several sheep products produced in your region for the last five years. Include prime fat sheep, wool and early lambs. (2) Make a graph with a line for each product showing the range of prices during this period.

Uses Made of Sheep.—In the United States sheep are kept primarily for their flesh and wool. Various leather products are made from the skin and numerous uses are made of the various parts of the viscera or offal. In western Asia, eastern Europe and to a slight extent in the United States, fur is made from the wool and skin. In a few countries in Europe and Asia sheep are kept for their milk as well as for their flesh and wool. In many instances the milk is consumed as such; in others it is converted into cheese.

Use of Mutton.—The annual per capita consumption of sheep flesh in the United States is about 5.3 pounds as against 63 pounds of beef and 77 pounds of pork. There are at least two explanations for the small consumption of this kind of meat. One is, that the supply is small and the other is, that many consumers are prejudiced against it because it sometimes possesses what is known as a woolly flavor. With the improvements that have been made in breeding and in the methods of feeding and slaughtering, however, the general dislike toward sheep flesh is rapidly declining and hence the chief cause, doubtless, for low consumption is the scarcity and high price of the product.

The meat from the mature sheep is called *mutton*. From the immature animal, usually less than a year old, it is called *lamb*, which is the same as the term applied to the young live animal. Lamb is much more popular with consumers than mutton. It is more tender and juicy, has less excess fat than the meat of the older animal and is less likely to have the so-called disagreeable woolly flavor.

Use for Wool.—Sheep in new countries are kept primarily for their wool because it is a product that can be handled to advantage in sparsely populated regions. Being light in weight and non-perishable so far as the time element is concerned, it can be moved to market centers even though transportation facilities are poor. But the wool remains an important consideration in sheep husbandry after the countries in which sheep are kept become thickly populated. There is always a demand for wool and it is possible to grow fairly good wool even on sheep which are best for meat purposes. Flock masters in the United States would not think of producing woolless sheep, because we consume more wool than we produce and in those regions where the most emphasis is placed on mutton production a considerable part of the income from the flock is derived from the wool product.

World Production of Wool and Mutton.—The United States stands fourth among the countries of the world in the production of sheep, being greatly exceeded by Australia, Argentina, and Russia. Production of wool in these and other countries influences somewhat the prices received for wool in this country. This is less true of mutton.

Influence of Other Farmers.—If a number of neighbors are raising sheep successfully, the beginner may assume that the region is favorable. It seldom pays to raise sheep in regions where others are not doing so. Sometimes sheep may well be raised where farmers have not begun this enterprise.

Sheep are most profitable where waste farm products can be used, where rough land can be used, and where feeds are easily grown on the farm. But this does not mean that sheep should not be grown on fertile, high-priced land.

Farm Flocks.—Small flocks of mutton breeds are commonly kept in fenced fields in all states and Canada except in the western states, where sheep having a large percentage of Merino blood are kept in very large flocks for the production of lambs and wool. Each sheep in the small farm flock is valued highly. Each ewe yields not only wool but also lambs which are sold for meat, and when she has passed her period of usefulness as a breeder and wool producer she still has a value as a mutton product. (Fig. 151).

Farm flocks vary in size from less than 25 to 400 or more, but few of them exceed 100. They are usually under the care not of special herders or shepherds but of persons entrusted with other farm duties.

Dogs and Diseases.—In some sections dogs destroy sheep and prohibit profitable sheep farming. This menace is liable to be found almost anywhere and owners must guard carefully against sheep-killing dogs. In certain regions wolves and coyotes have to be dealt with as enemies of the sheep. Parasitic worms cause great annual losses among flocks. Several pastures may be needed to provide changes in the summer time and proper treatment is necessary though not expensive.

Equipment.—Inexpensive sheds and feeding places and low fences are sufficient for sheep farming. Dry, well-drained quarters, not too closely enclosed, are best for winter protection.

Labor.—The labor items include care at lambing time, shearing in the spring, docking lambs' tails, feeding, particularly in the winter, and care of pastures in the summer. The annual labor cost for a flock of forty or fifty sheep is relatively low.

Home Grown Crops and Pastures.—Farmers keeping sheep should all raise sufficient grain, hay, and fodder to avoid the buying of any feeds for sheep. Pastures with good water and shade should be provided. Rough land, however, can be used (Fig. 152). If the place is infested with cockleburs, burdocks, or similar bad weeds, sheep will be much less profitable. Weeds which do not bear burs are not objectionable. Sheep will help destroy such weeds; but burs get into the wool, reduce its selling price and scatter the seeds everywhere.

FIG. 151.—Project with breeding ewes and lambs. A good grade flock on ideal early pasture. (J. C. Allen.)

Several pastures should be provided so that sheep may be moved every two weeks from one pasture to another, if necessary, in controlling sheep worms.

Prices for Products.—If lambs can be produced for market very early, prices will be good. Wool usually brings good prices if it is reasonably free from burs and is properly prepared for market. Mutton prices are sometimes low but are usually reasonably high for the best animals fattened for market.

Projects.—In sheep husbandry, projects may start in several ways

(a) with purchased ewes; (b) with weanling lambs to be raised for breeding (Fig. 153); (c) with ewes and lambs at side; (d) with a bunch of wethers or lambs for feeding and marketing. The scope and time of either (a) or (b) may be planned to include the others. Beginners who start with (d) may gain experience and funds for the pursuit of a permanent sheep enterprise.

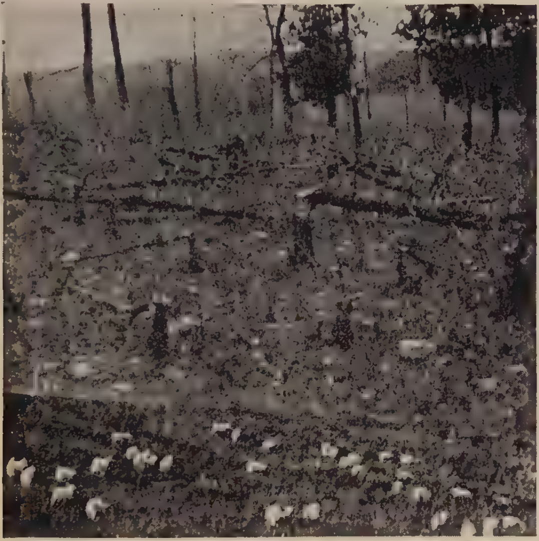

Fig. 152.—Keeping down brush sprouts in new pasture lands by pasturing Angora goats and sheep. (Missouri Station.)

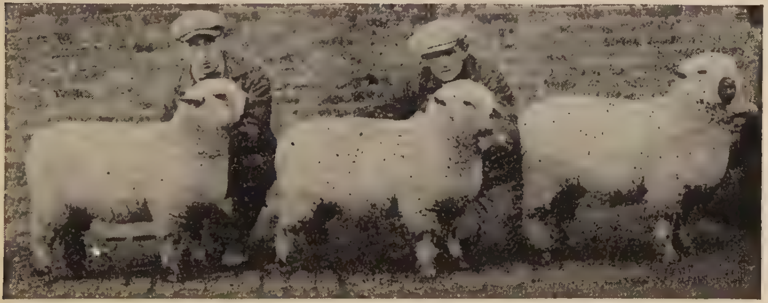

Fig. 153.—First prize pen Shropshire ewe lambs, International Livestock Show. Bred and exhibited by the University of Minnesota.

Job 2. Choosing the Type and Breed of Sheep

Conditions Usually Found.—(1) There are very few breeds found in any one locality. (2) The type suited to the locality is usually known and used. (3) Farmers often realize the advantages of pursuing special phases of the enterprise.

Aim.—Farmers should know the different types and breeds of sheep and their adaptation to special purposes and regions.

Problems for Study and Discussion.—(1) What are the three main types of sheep in America?

2. Name the breeds of each of these types of sheep.
3. Compare the breeds of fine-wooled sheep as to wool, flesh and other characteristics.
4. Compare the breeds of medium-wooled sheep and decide which is best suited to your region.
5. Compare the breeds of long-wooled sheep as to size, length of wool and use for mutton.
6. What types and breeds are most popular locally?
7. Compare the local breeds with the purposes or aims in view.
8. Ask sheep raisers what their special purposes or aims are in keeping sheep, and find how the breed kept suits this purpose.

Activities.—(1) Make a chart for the school room or for use at farmers' meetings showing three main types of sheep and the breeds coming under each type. (2) Collect samples of wool of each of the breeds in your region: mount these on a dark colored card for comparison.

The Breeds of Sheep.—The outline indicates the breeds of sheep that are more or less common in the United States. There are many other breeds but it does not seem advisable to mention them in this connection. The mutton breeds are divided into two general classes according to the length of the wool. Those having very long wool are called the long-wooled or coarse-wooled breeds; those having short wool and wool of medium length are called the medium-wooled breeds.

With the exception of the Corriedale and the Tunis, all of the mutton breeds indicated in the outline were developed in Great Britain. Five of the mutton breeds, the Southdown, the Shropshire, the Hampshire, the Oxford, and the Suffolk, are known as the "down" breeds. The Dorset Horn is really a "down" breed, too, but is not generally so regarded. They probably got this name from the fact that they were developed from stocks that were once common on the low hills known as "downs" in central and southern England.

Classes and Distribution of Breeds of Sheep in the United States

Mutton Breeds

Medium Wool		Long Wool	
Shropshire	wide	Lincoln	wide
Southdown	wide	Cotswold	wide
Hampshire	wide	Leicester	fairly wide
Oxford	wide	Romney	not wide
Dorset Horn	fairly wide		
Cheviot	fairly wide		
Suffolk	not wide		
Corriedale	not wide		
Tunis	not wide		

Fine Wool Breeds		Fur Breed	
American Merino	fairly wide	Karakul	not wide
Delaine	fairly wide		
Rambouillet	wide		

MEDIUM-WOOL MUTTON BREEDS

The Southdown.—This is the oldest of the "down" breeds, having been developed in southeastern England on the hills known as South Downs, beginning about 1775. In the United States Southdown flocks are most numerous in the eastern and southern states. They are not numerous in the middle western and far western states.

Form and Weight.—The best specimens of the Southdown closely approximate the ideal mutton type. (Fig. 154). The body, which is somewhat oval on top, is wide, deep, low-set, and evenly covered with deep, firm flesh. The neck is short, thick, and placed so that the head is carried on a line just a little higher than the shoulders. The arch of rib, the smoothness at hip and at lower shoulder point, the fullness at forearm, thigh, and twist suggest a rotund rather than a rectangular conformation. A compact, symmetrical block of mutton fittingly summarizes Southdown form. Mature rams in breeding condition weigh from 185 to 200 pounds; ewes from 135 to 155 pounds.

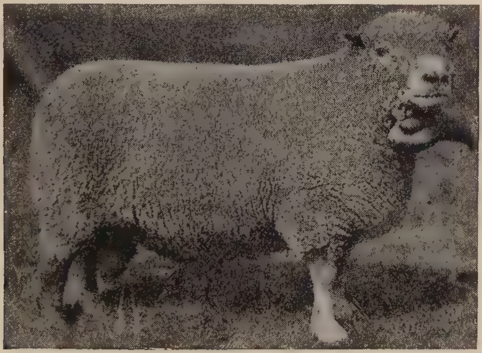

FIG. 154.—Typical Southdown ram. This is the smallest breed of the medium-wool group of sheep, and is much used for the production of lambs for early market.

Features.—The mouth and nostrils are fairly large. In ewes the profile of the face is slightly dished; in rams, it is almost straight. The eyes are large and prominent. The ears are short and erect; the legs straight, short, and wide apart. The features as a whole give the true-type Southdown an appearance of smartness.

Markings, Wool and Skin.—The color of face and legs varies from light steel gray to a light soft brown. Clear, pink skins are preferred. Fleeces range in weight from five to eight pounds and in twelve months attain a length of about two inches. The wool should extend over the cheeks and over the head to a line even with the eyes. Below, it should cover the belly and extend at least to the hocks and knees.

Disqualifications.—(a) Horns or evidence of their presence.

(b) Dark wool on top of head.

(c) Very blue skin.

(d) Speckled face, ears and legs.

(e) Poor wool, meaning coarse wool on the thighs and wool not typical of the breed.

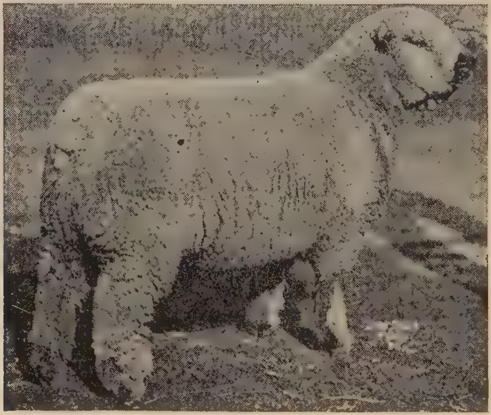

Fig. 155.—Shropshire wether, grand champion over all breeds, International. (American Sheep Breeder.)

Properties.—The Southdown is famous for the quality of its mutton. The lean is fine grained, juicy and firm; the fat white, flaky and sweet. Because of its superior fleshing qualities, the Southdown has been used in improving a number of breeds. It has also been used extensively in cross-breeding and in grading-up flocks.

The breed is hardy, the lambs mature early and weigh about 50 pounds when three months old. The ewes are excellent mothers and a flock will produce 125 to 150 lambs to each 100 ewes.

The Shropshire.—This breed was developed in Shropshire and Staffordshire counties, England, from several native strains which were crossed with Southdowns, Cotswolds and Leicesters. A number of men were instrumental in building up the breed. It was first exhibited at the Royal Show of England in 1845. Shropshires are widely distributed in America. They are very popular in eastern and middle western sections.

Form and Weight.—In shape of body and length of legs the Shropshire is very much like the Southdown, but its neck is longer and more arched; the head is carried higher and is proportionately broader between the ears and eyes, it is slightly longer and stronger in face profile; the ears are attached a little lower down on the sides of the head and are not quite so nearly erect; the hair on nose, ears and legs is a darker shade of brown and the wool is longer, not so fine, and extends down farther over the face and legs. Mature rams in breeding condition weigh from 200 to 250 pounds; ewes from 150 to 180 pounds. (Figs. 155 and 156).

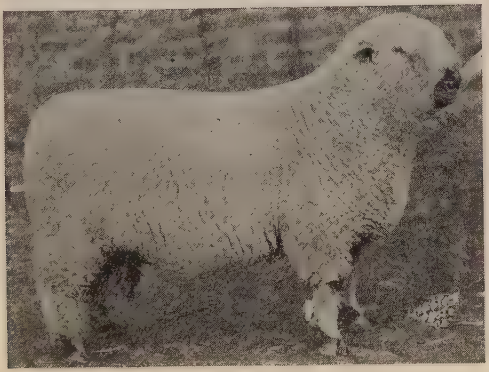

FIG. 156.—First prize Shropshire ram lamb and American bred champion Shropshire ram at International Livestock show. Bred and exhibited by University of Minnesota.

Markings, Skin, and Wool.—A deep soft brown is the color preferred for the hair on the face, ears and legs, but bluish or steel grey markings are not seriously criticized. The skin should be a bright pink or cherry red; dark skins and spotted skins are very undesirable.

In twelve months Shropshire wool should be from two and one-half to three inches long and the fleeces should weigh from eight to ten pounds. The wool is fairly fine, grading from one-fourth-blood to three-eighths-blood combing, which are medium combing wools. No other mutton breed equals the Shropshire in extension of wool over the face and legs, as it extends almost to the muzzle on the face and to the pasterns on the legs. Frequently the ears carry a growth of wool. Breeders object to dark wool even on the face and legs, and dark fibers in the main body of the fleece are regarded as a serious fault.

Horns never appear in the ewes, but they are likely to show in the rams. They are considered objectionable.

Properties.—The Shropshire is a mutton sheep of high quality and ranks well as a wool producer. The Shropshire lamb finished for market at a weight of about eighty pounds is a prime meat product.

The Shropshire thrives under a wide range of climatic and soil conditions. It is a cosmopolitan breed. It is average in hardiness and well above the average in prolificacy. One hundred vigorous breeding ewes will produce from 150 to 175 lambs. The ewes are good mothers, but because of their prolificacy, breeders need to pay especial attention to milking qualities in selecting females for their flocks.

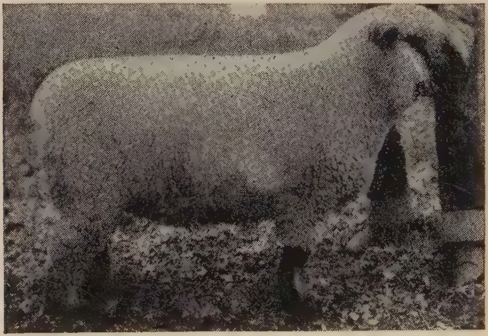

Fig. 157.—Champion Hampshire ewe, Pacific International and American Royal shows. Reserve champion Chicago International. Owned by Mt. Haggin Land and Livestock Co., Anaconda, Mont. (Am. Hampshire Sheep Assn.)

The Hampshire originated in the rolling, light, chalky lands of South Central England in the county of Hampshire. In the United States the breed is fairly well distributed, but is not nearly so popular as the Shropshire.

Form and Weight.—The Hampshire is a bold, massive, thick-fleshed, hornless sheep with a long, deep, symmetrical body, heavy bone, and striking head features. It is one of the most impressive sheep to be seen in modern show yards. (Figs. 157 and 158).

Mature rams in breeding condition weigh from 250 to 300 pounds; ewes from 180 to 225 pounds. The head, contrasted with that of the Southdown and Shropshire, is large, and the face profile is slightly Roman in females and decidedly so in males; the ears are long, fairly wide and thick, and attached so as to fall slightly outward and forward when the animal is at attention. The neck, although rather long, should be thick and muscular. The legs are of medium length and the leg bones should be large and strong, but not coarse.

Markings, Skin, and Wool.—The hair on the face, ears and legs is a very dark brown approaching black, and makes a sharp contrast with the white wool on the head and legs.

The skin of the Hampshire should be pink, but there is a strong tendency toward very dark skins. Horns or evidence of their presence amount to a disqualification.

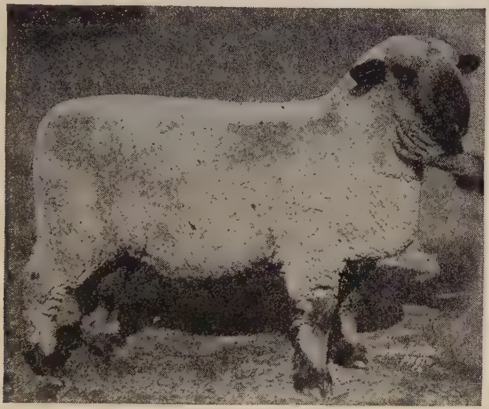

FIG. 158.—Champion Hampshire lamb International. Owned by Thousand Springs Farm. (Am. Hampshire Sheep Assn.)

As a wool producer the Hampshire does not rank high. Fleeces weigh about eight pounds each and in twelve months the wool should be nearly two and one-half inches long. In fineness it is about the same as the Shropshire.

Properties—Rate of Growth.—Hampshires are distinctive for their size, rate of growth and early maturity. Because of these properties they are steadily gaining in popularity in nearly all parts of the United States.

Other Good Qualities.—Hampshire ewes are prolific, strong in maternal instinct and good milkers. In crossing and up-grading, the Hampshire ram strongly impresses his characteristics on his offspring.

The Oxford.—This breed was originated in Oxford county, central England, by crossing the Cotswold and Hampshire breeds. It was given a place as a breed at the Royal Show of England in 1862. There are many Oxford flocks in the middle western regions of America.

Form and Size.—The Oxford is a large, somewhat upstanding sheep with strong bone. The top of the body is very wide and in contour approaches the rectangular rather than the oval characteristic of the Southdown and Shropshire. The head and ears are a trifle smaller and the face profile less inclined to be Roman than in the Hampshire. Mature rams in breeding condition weigh from 275 to 325 pounds, and ewes 200 to 225 pounds.

Markings, Skin, and Wool.—The color of the hair on the face and legs varies from a dark brown to a steel grey with the dark brown preferred by most breeders. Bright pink skins are more desirable than either dark or spotted skins. Dark wool on either head or body is objectionable. Any evidence of horns is undesirable.

In twelve months Oxford wool should be three to four inches long. The wool should cover the top of the head and extend to a line even with the eyes. In quality the wool is coarser than that of the Shropshire. It grades one-fourth-blood combing or lower. Fleeces weigh from ten to twelve pounds and even more.

Properties.—Great size, outstanding weight and quality of wool for a Down breed, prolificacy and deep milking qualities are the attributes which Oxford breeders claim for their sheep. Oxford rams are often very desirable for crossing purposes.

The Suffolk was developed by crossing the Southdown on an old Norfolk breed of southern England. It was first recognized as a breed in 1859. Suffolks are not numerous in the United States. In some western states they are very highly regarded for crossing on range ewes for the purpose of producing market lambs.

Description.—Suffolks are hornless; their heads and legs are free from wool covering and the hair on these parts is very dark. Their ears are long and their faces long and distinctly Roman. In conformation they tend to ranginess, but they are plump and exceedingly well developed in the parts valuable as meat. The wool is short and similar to that of the Hampshire in quality. It often fails completely to cover the under side of the body. Seven pounds is about the average weight of fleece. Rams in breeding condition weigh about 250 pounds; ewes 165 pounds.

Properties.—The Suffolk is very highly regarded for the quality of its mutton. It has no superior for a large proportion of firm, fine-grained, lean meat.

The Dorset Horn.—This breed was made from selections from native stock in the counties of Dorset and Somerset in south-central England. As a general farm sheep, the Dorset Horn, being deficient in quality and shearing properties, is not popular, and hence it is not so widely distributed as certain of the other medium-wool breeds.

Form and Size.—The body is long and wide in proportion to depth, the bone and head features are strong and the whole makeup is suggestive of ruggedness. Both males and females have horns. Mature rams in breeding condition weigh about 275 pounds, and ewes from 180 to 200 pounds. (Figs. 159 and 160).

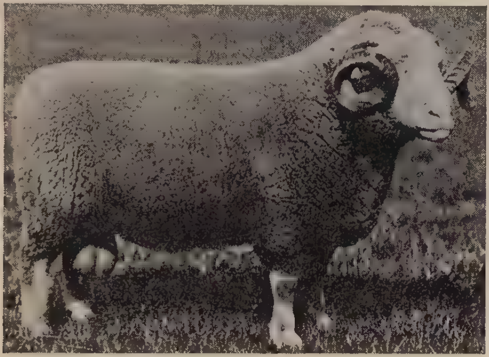

Fig. 159.—Two-year-old Dorset ram. (Continental Dorset Club.)

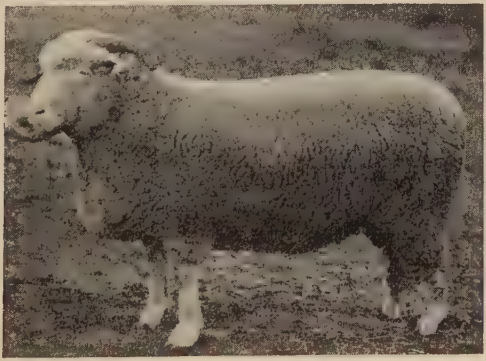

Fig. 160.—Yearling Dorset ewe. Note symmetry and style in conformation. (Continental Dorset Club.)

Markings, Skin, and Wool.—The face and legs of the Dorset Horn are white. Even the lips, nostrils, hoofs and horns are free from dark pigment. There is no suggestion of darkness in the skin.

The wool should extend over the entire body, but there is very little on the legs below the hocks and knees. It should cover the cheeks and the top of the head, but the face should be free from wool covering. In twelve months the wool should be about two and one-half inches long. Fleeces weigh approximately seven pounds each.

Properties.—The Dorset Horn is a vigorous, hardy sheep that thrives on both pasture and forage crops. The ewes are noted for their deep milking properties and hence they rank high in their ability to grow lambs rapidly for special or out-of-regular-season markets. Unlike most of the mutton breeds, they can be handled so that they will produce their lambs in the autumn or early winter. Growers located near large cities where there are consumers willing to pay a fancy price for special products find it profitable to keep Dorset Horns in order that they may market finished milk-fed lambs at a time when the supply is very limited.

Cheviots.—This is a hill or mountain breed from England, and its high shoulders, trim build, alert carriage, and active movements indicate that it is adapted to its rugged native home. It has been known to thrive, however, on the level farm lands of the central and eastern states. The head, ears and legs are covered with short, hard, white hair which should in all cases be free from a reddish tinge. There may be distinct black spots on the ears and occasionally on the face, and the nostrils, lips and hoofs are black. The skin is a deep pink. The ewes are hornless, but rams sometimes have horns. In twelve months the fleece should be four inches long and it should weigh from six to eight pounds.

The Corriedale.—A blend in both body and fleece characteristics of the two breeds, Lincoln and Merino, produced the Corriedale. It is not the equal of the strictly mutton breeds in fleshing qualities, but is sufficiently developed in this respect to produce good mutton. Its wool is very white, and in twelve months attains a length of three or more inches. It grades three-eighths and one-half blood combing and usually commands a high price. Fleeces average ten to twelve pounds in weight. Body weights are not well known. Mature rams in breeding condition weigh about 225 pounds; ewes 150 to 165 pounds.

The face, ears and legs are white. Both sexes are hornless but there is a tendency for horns to appear in the rams.

Corriedales are to be found almost entirely in the western states. They were first brought to this country from New Zealand in 1914 by the U. S. Government. As range sheep they are proving very satisfactory. The ewes are sufficiently prolific, and they are good mothers. As a cross between a mutton and a fine-wool type, they excel in wool production.

The Tunis.—This breed was developed from stock that came from Tunis, Africa and contains Southdown blood. The distribution in this country is exceedingly limited; most of the flocks are to be found in the state of Indiana. The ewes will breed to lamb at almost any time in the year for special lamb production, but in form and fleshing qualities this is not equal to such breeds as the Shropshire, Southdown and Hampshire. The wool is frequently coarse.

The ears of the Tunis are long and pendulous. The color on face, ears and legs varies from a reddish brown to white, and often a wide bar of white hair extends from the nose to the forehead. At birth the lambs may be spotted or reddish brown.

Long-Wool Mutton Breeds

The Leicester.—This large breed was developed in central England about 1760. The breed is not popular in this country because of lack of hardiness and breeding powers. The ears, face, and legs of the Leicester are covered with short, bluish-white hair, but the hoofs and the bare skin on the nose are black. The body-skin is pink or cherry in color. Both sexes are hornless.

The wool of the Leicester may form a tuft on the forehead or the head may be entirely bare. Likewise, there may be some wool on the legs below the knees and hocks, but they are usually bare. At twelve months the wool is seven or eight inches long; it terminates at the outer end in a short twisted curl.

Leicester mutton carries too much fat and the lean is too coarse to be of first quality. The great value of the Leicester is derived from the benefits secured when it is crossed with other breeds; it imparts rapid fattening propensities, especially where grass must be relied upon for feed. Pure-bred Leicester ewes are lacking in prolificacy; they are not reliable breeders and they are deficient in milking properties.

The Cotswold is a very large upstanding stylish sheep, from Cotswold Hills, England, adapted to light grass lands. The breed is less hardy than breeds of medium wool because of parting of the wool which results in the fleece being of less protection to the health in rainy weather than is the case with breeds having a thicker covering of wool. The mutton is similar to that of the Leicester but less fat. Mature rams in breeding condition weigh from 275 to 300 pounds; ewes from 185 to 225 pounds. (Fig. 161).

The hair on the face may be white or white with light grey or brown specks; the hair on the legs may be white, or white mixed with grey or brown. The lips and nostrils are black and so is the skin around the eyes. The body skin is a deep pink.

There is a well developed tuft of wool on the forehead. There may be wool below the hocks, but little below the knees. At the surface of the fleece the wool should lie in large open curls. In twelve months the wool should be from ten to fourteen inches long, and fleeces average from ten to fourteen pounds in weight. The wool, like that of all the long-wool breeds, is rather coarse and classes as braid. The Cotswold is hornless.

The breed is widely distributed in the United States, but except in the Far West, the flocks have been largely replaced by the medium-wool breeds.

The Lincoln.—This is a large breed which resembles the Leicester and is related to it, but has even greater size, more robustness, more strength of bone, firmer flesh, and more wool. The Lincoln has a longer head, a broader face and a fuller and bolder face profile. Its ears are larger. The Lincoln is a breed of great substance. From brisket to twist the carcass is thick and heavy. Large development in the leg is especially sought. Mature rams in breeding condition weigh about 300 pounds; ewes 250 pounds. (Figs. 162 and 163).

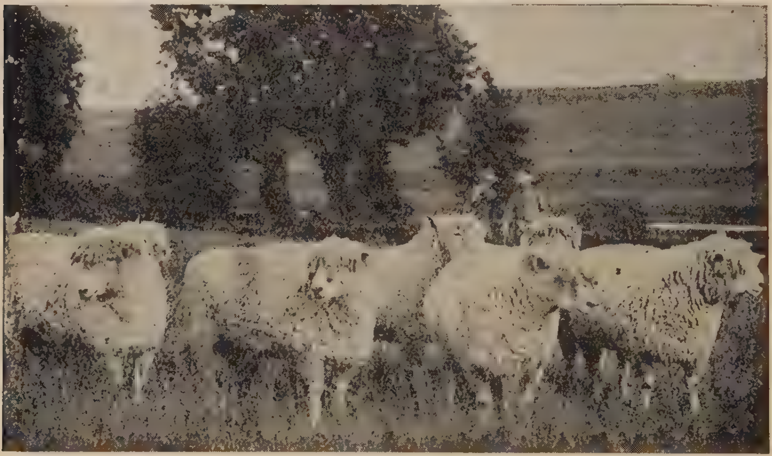

Fig. 161.—Yearling Cotswold rams in their native English hills.

The markings of the Lincoln are white; occasionally a little dark color is seen on the ears and legs. The lips, nostrils and hoofs are black. The skin is a deep pink or cherry in color. The breed is hornless.

Lincoln wool is very long and lustrous. At twelve months' growth it is about twelve inches in length, and fleeces may weigh fifteen pounds. The wool covers the body and forms a tuft on the forehead. It extends to the knees and hocks.

The Lincoln is a heavy feeder and hence requires an abundance of feed. The ewes are good mothers, but in prolificacy and quality of mutton the breed is not of first rank. The breed is most popular in the western states, where it is often used for crossing on Merino ewes.

Romneys.—This breed is large, strong in bone, rather low-set and rugged.

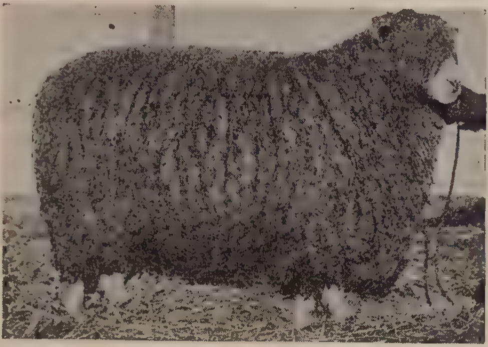

Fig. 162.—Lincoln ewe, grand champion International Livestock Show. (Natl. Lincoln Sheep Breeders' Assn.)

Romneys are not numerous in the United States. They have given success in the West in crossing with Merino ewes. The wool is not as long and lustrous as that of the Lincoln and Cotswold but it is more dense and finer. Fleeces weigh from twelve to fourteen pounds.

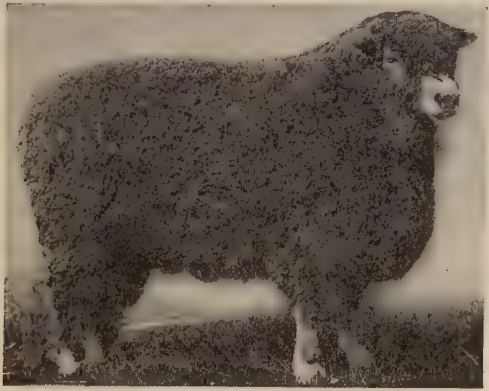

Fig. 163.—Lincoln ram, winner at British Royal Livestock Show. (Natl. Lincoln Sheep Breeders' Assn.)

The Romney is a hardy sheep and it is especially suited to low-lying pastures, which is a property not possessed by many breeds. It thrives also on comparatively high, rolling pastures. It is a superior grazing sheep.

THE FINE-WOOL BREEDS

In the wool breeds of sheep, special emphasis is placed on the qualities of fleece as indicated by fineness of fibers, number of fibers per square inch of skin surface or density, the length of fibers, the amount of yolk secreted, and the evenness with which the wool is carried over the body with respect to fineness, density and length.

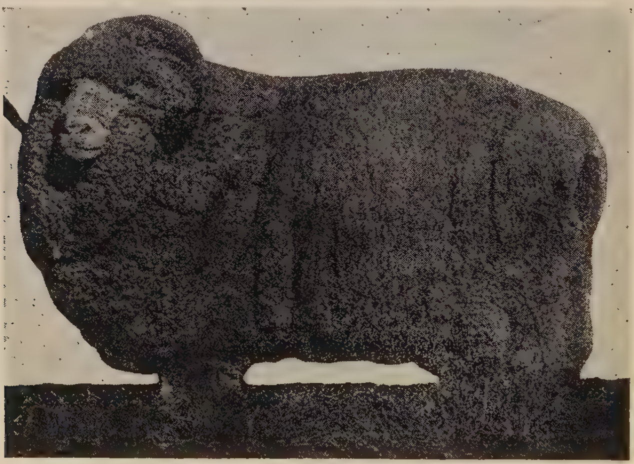

FIG. 164.—Merino ram, David of Dalkeihl, sold to F. G. Falkner & Sons, Boonoke, N. S. W., for $26,075. His 12-month fleece weighed 42 lbs. (*Am. Sheep Breeder.*)

The wool breeds of the United States were developed from Merinos that came originally from Spain. In addition to unusual wool qualities, these sheep had another characteristic that has been of much importance in building up the sheep husbandry of the western states. Practically all breeds of sheep have the habit of flocking or staying together, but the Merinos have the habit in much more pronounced degree than any of the breeds that carry no Merino blood. In the West, where sheep are handled in the open range by herders, it is almost impossible to care for sheep having no Merino blood because they will not stay in a compact body while grazing.

In the early days in America, wool production was much more important than mutton production. This caused growers to seek Merinos.

They soon became popular, and because of their wool qualities and their flocking or gregarious instinct they have continued to play an important part in the sheep husbandry of this country. Now that mutton is in strong demand there is much crossing between the wool and the mutton breeds. At one time the preponderance of blood in western range flocks was Merino; today the blood in range ewe bands is approximately half-and-half of the mutton and the wool breeds.

The American Merino.—The sheep from which the American Merino was developed were imported from Spain late in the eighteenth and early in the nineteenth centuries. In the hands of American breeders in Vermont, New York, Ohio, Pennsylvania, and Michigan, pronounced improvement was made in form of body and in weight and quality of fleece. (Fig. 164).

Description.—American Merinos vary considerably with respect to form, the number of wrinkles or folds in the skin, and the length, density and fineness of wool. On this account there are three well defined types that are quite generally recognized. They are known as A-type, B-type, C-type. (Fig. 165).

The A-Type.—The outstanding characteristic of this type is the extreme development of folds on neck and body. The wool covering is very dense and there is a heavy deposit of yolk. In twelve months the wool becomes about one and one-half inches long. Rams shear from twenty-five to thirty pounds; and ewes from fifteen to twenty pounds. In the process of scouring or cleaning the wool of the A-type Merino often shrinks more than seventy-five per cent.

In body conformation the A-type American Merino is short in leg and deep in body, but the straightness of top line, the spring of rib and the fulness of parts characteristic of the mutton breeds are lacking.

The B-Type.—This has fewer folds than the A-type. Three to four large folds are to be found on the neck; fairly prominent ones appear at the flanks and around the dock, and a goodly number of small ones on the thighs and sides of the body.

Because of less expanse of skin the B-type shears less wool in proportion to size of body than the A-type. Their fleece characteristics are very similar, but the B-type is inclined to carry a smaller proportion of yolk and a little greater length of wool fiber. The B-type tends to be wider in spring of ribs than the A-type and fuller in thigh and twist.

Mature rams weigh from 140 to 170 pounds; ewes from 100 to 125 pounds. Rams shear about twenty-five pounds; ewes about sixteen pounds.

The C-Type or Delaine.—There is really no difference between the C-type Merino and the Delaine. The body of the C-type is free from

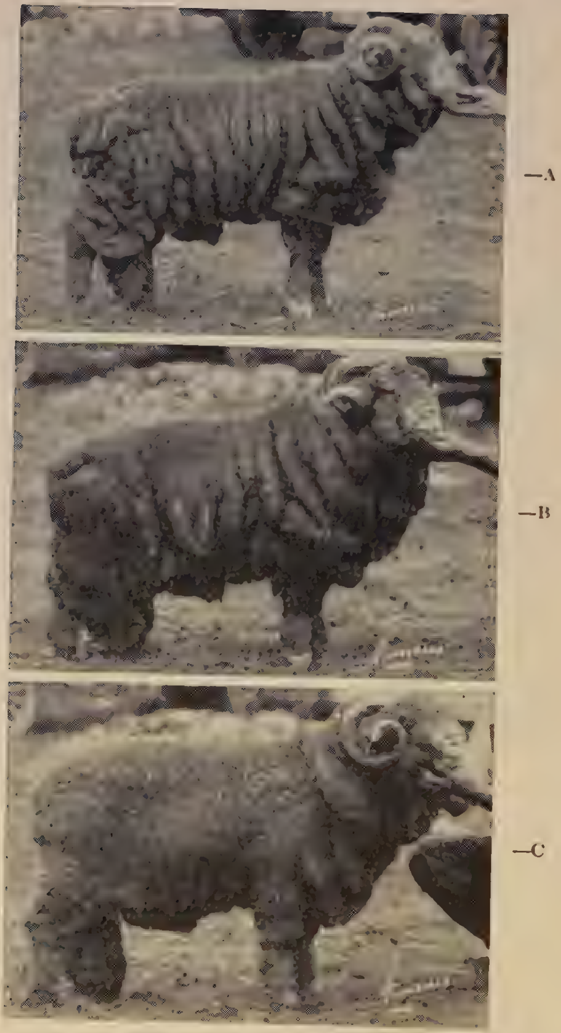

Fig. 165—Types A. B. C., of Merino rams. (American and Delaine-Merino Record Assn.)

folds, and only two or three small ones appear on the neck. The C-type possesses average mutton qualities and the finished lambs sell well on the markets. It is much more pronounced in mutton properties than the B-type.

Rams range in weight from 150 to 200 pounds; ewes from 100 to 150 pounds. Rams shear from fifteen to twenty-five pounds; ewes from ten to fifteen pounds. The wool is three inches or more in length at twelve months' growth. It is a fine combing wool and it contains less yolk than the wool of the B-type. It is, in general, the most desirable wool produced in America.

The vast majority of rams of the Merino type have horns. Occasionally horns appear in ewes. Fairly successful efforts are being made by a few breeders to produce hornless sheep. In all three types extreme extension of wool over the face and legs is favored. All three types have fine, white, silky hair on face and legs. The skin on the nose is white.

Properties of American Merinos.—Wool production and the gregarious instinct are the outstanding features of the Merino breeds. Hardiness and the ability to pull through with a fairly good wool product where the feed is poor are also characteristic of them. The ewes are not as prolific, nor as good in maternal and milking qualities as the ewes of the mutton breeds. Pure-bred flocks are not as numerous as in former times. Ohio, Pennsylvania, New York, Michigan, and Texas have most of the flocks.

The Rambouillet. (Fig. 176).—This breed was developed by breeders in France and Germany from Spanish stock. It began to be popular in the United States at the beginning of the present century and it is now the most popular wool breed in this country.

Description.—Like the Delaine Merino the Rambouillet is fairly well developed in mutton qualities, and it is considerably larger than any of the American Merino types.

The Rambouillet varies much with respect to neck and body folds, length and fineness of wool and mutton properties. There are really the B-type and C-type within the breed. Many breeders in Ohio incline to the B-type while the majority in the west prefer the C-type. The B-type produces more grease wool, is inclined to have shorter wool, and is more deficient in mutton form than the smooth or C-type.

In general the Rambouillet is not as uniform in fleece qualities as are the various types of American Merinos, and apparently it is more difficult to grow long, fine, even fleeces on the smooth or C-type than it is on the C-type or Delaine Merino.

In twelve months Rambouillet rams grow from fifteen to twenty-five pounds of wool; ewes from ten to eighteen pounds. The length of wool varies from one and one-half inches to three inches or more. Most breeders favor extreme extension of wool over face and legs, but a few breeders in the West are beginning to see the folly of this requirement, as wool on the head makes it impossible for the sheep to see its way about and wool on its legs collects snow and mud in winter.

Mature rams in full fleece weigh from 225 to 250 pounds; ewes from 140 to 170 pounds. Most of the rams have large spirally turned horns, but as a rule the ewes are hornless. The skin on the nose, the horns, and the hoofs are usually free from dark pigment.

Properties.—The Rambouillet has forged ahead because it possesses the gregarious instinct in the same degree as do other Merino breeds; it is hardy; and it is larger and of better mutton conformation than other Merinos. It is also more prolific, and the ewes are better mothers.

Fur-Bearing Sheep

The Karakul.—There are very few of these sheep in the United States and it cannot be said that growing sheep for fur is an established national industry.

The Karakul comes from Bokhara, Asia. It is ill-shaped, develops a mass of loose fat at the dock and is deficient generally in mutton properties. Its wool is coarse and wiry and as a product from the mature animal of low value. When the lambs are born, they have lightly curled, glossy black coats; and in order to get the best fur from them they should be slaughtered by the time they are five days old.

Job 3. Selecting and Buying Stock for Breeding and Feeding

Conditions Usually Found.—(1) Too many growers are likely to be satisfied with grades or scrubs rather than improved stock. (2) Sheep raisers who have used improved animals for breeding realize the benefits derived therefrom. (3) Most sheepmen are capable of selecting good individuals for breeding and for feeding. (4) Improvement of stock is usually accomplished by buying pure-bred rams of superior quality.

Aims.—(1) Beginners should practise selecting, judging, and comparing animals of the same class until they become expert. (2) They should calculate the best methods of procuring stock for breeding and for feeding.

Problems for Study and Discussion.—(1) Compare the skeleton of the sheep with that of the cow and indicate the ways in which they are similar.

2. Study the skeleton of the sheep—note the points at which there is variation in the number of parts and estimate the probable effect of these variations on the body conformation of animals.
3. Consult all the authorities you can find to determine whether or not there are woolless breeds of sheep. Under what climatic conditions do you think such breeds would thrive best?
4. How are the temporary and permanent teeth in sheep arranged in the upper jaw? In what respect is the arrangement different from that in human beings? Compare it with the arrangement in cattle.
5. Why are straight rather than crooked legs desirable in sheep?

6. Consult books, bulletins and markets in order to learn what parts of the sheep's carcass sell for the most money per pound.
7. What would you look for in determining whether or not a sheep has a strong constitution?
8. Tell how to study breed type.
9. Tell how to use the hands in examining the body of a sheep; its fleece.
10. Ask growers how they procured their first flocks of sheep when they started.
11. Find what prices would have to be paid for good stock for breeding and for feeding in your region.
12. Decide on what stock and what numbers of each you would procure in starting the sheep enterprise yourself.
13. Make a list of the important points to be considered in buying rams of the type used in your region.
14. Make a list of the main points to consider in buying ewes of this type for breeding purposes.
15. Describe the main features to be found in good feeders for mutton.
16. What are the characteristics of a finished top lamb?
17. What are the characteristics of a finished mutton sheep?
18. Get farmers to compare animals of the various classes, giving their reasons for those which they consider best.
19. Give directions to follow in looking a sheep over while judging.

Activities.—(1) Practise judging and comparative placing of sheep of each class found in your region. (2) If a sheep has died in the neighborhood, obtain the carcass, remove the skin and viscera, then boil the body to remove the flesh so the skeleton may be mounted for study. Several students may assist each other in this operation. Lye in the water will aid in removal of flesh from the bones and will tend to whiten the bones.

Buying Sheep for the Breeding Flock.—The beginner should usually choose a breed common to the region in which he lives. After this has been done he should consider the sizes of the pastures available as a factor influencing the size of the flock. If the market is good for winter lambs, select ewes which will produce early lambs.

It is better for the beginner to start with young animals and with a small number than to pay high prices for expensive ewes. Buy from reliable breeders only.

Where to Buy Ewes.—There are two main sources from which to draw ewes for the farm flock. First, they may be secured locally in almost every part of the country where farm flocks are kept. Second, they may be purchased during the summer and early autumn months on the large livestock markets where both native and western ewes are sold as foundation stock for farm flocks.

Financing the Enterprise.—Borrowing capital with which to purchase breeding stock is a common plan. Funds may sometimes be secured from other projects or from money earned while working with experienced sheep breeders. A young man working with a good breeder at a fair wage is getting not only capital for himself but also valuable experience. This may result not only in the acquiring of capital but in saving from losses which otherwise might occur.

One student earned capital by shearing flocks for his neighbors. A small beginning is all that is necessary for the sheep enterprise. Young farmers should start early with a savings account. Thrift in all money matters will make a young man able to start a farming enterprise such as sheep growing more easily. He should calculate the cost in advance.

Types of Sheep.—In the United States and in most of the important sheep-producing countries there are two general types of sheep. One is known as the mutton type; the other as the wool type. In the mutton type, growing, fleshing, and fattening qualities receive primary consideration. In the wool type, the wool or fleece is of first importance. There are a few so-called "dual-purpose" breeds in which the mutton and wool are about equally stressed. The dual-purpose type does not equal the mutton type in meat qualities, nor the wool type in wool qualities; but there are conditions under which such a type may be more profitable than either the mutton or the wool type.

At present, some consideration is given to both mutton and wool in all of the improved breeds in the United States. The carcasses of the extremely developed wool type are of low value to the butcher, however, and the wool of the extremely developed mutton type is of rather minor importance.

In examining a sheep for meat or mutton development, about the same things are expected as in examining cattle for beef development. But the judging of the wool is a process quite different from any procedure in the judging of other classes of livestock with the exception of the Angora goat.

Age and Sex Names Applied to Sheep.—The mature male sheep is known as a "ram." In the western states and on the large markets the term "buck" is commonly used. The mature female is called a "ewe." The immature sheep is called a "lamb." If a male, it is called a "ram lamb"; if a female, "ewe lamb." Emasculated or castrated males are called "wether lambs," or, when mature, "wethers." It is very common practice to use such terms as "yearling ram," "yearling ewe," "two-year-old ram," etc. At most of the fairs and expositions in the United States all animals two or more years of age are listed in the aged classes according to sex.

Catching and Holding the Sheep.—Although a fairly good idea of the form and fleshing of a sheep may be gained merely by viewing it, an accurate judgment is not possible unless the examiner passes over the animal with his hands, because the wool often gives a deceptive appearance to its real form and condition with respect to flesh and fat. Since it is necessary for the judge to get his hands on the animal it is advisable that he develop at least a fair degree of skill in catching a sheep.

A sheep should not be caught by the wool, as there is danger of pulling it out and of injuring the skin; moreover, such a hold may fail in preventing the sheep from breaking away. A shepherd often grasps the sheep around a hind leg just above the hock joint. He passes his free hand to a firm hold on the loose skin under the jaw. He then releases the hold on the leg and places a hand either on the back of the head or at the "tail head" or "dock," as it is called in sheep. A variation of this method is to catch the sheep by the loose skin of the rear flank and proceed to a grasp on the jaw as stated. Most sheep are peculiarly helpless when caught by the rear flank hold. A crafty sheep-killing dog knows this, and his depredations in a flock nearly always show tooth marks on the flanks of his victims. It is usually fairly easy to hold a sheep while some one else handles it by grasping the skin under the jaw and by keeping a hand on the back of the head. If no one is present to hold the animal for the judge, he can gain a fairly good idea of form and fleshing by keeping a hold on the jaw and examining with his free hand.

Method of Examination.—Every judge should develop a definite method of examination. If possible it is best to look at the sheep carefully before handling it. Judges frequently look too little and handle too much. In both looking and handling, concentration on the task at hand is very important. In viewing, the sheep should be seen from the front, the side and the rear. From the front view, a study should be made of the make-up of the head, the width, depth and fullness of brisket, and the placing, straightness and length of the fore legs. From the side view, the size, the style, the length and depth of body, the length and setting of neck, the top and bottom lines, the "low setness," the "straightness" of legs and the strength of pasterns should be noted. From the rear, observations should be made with respect to width and evenness of body, development of hind quarters and set of legs.

After carefully viewing the sheep by some such method as described, the judge is ready to handle it, chiefly for the purpose of determining whether or not it is what it seemed to be from viewing it. In addition, he will determine the depth and firmness of its flesh and the length, density, fineness, color and evenness of its wool.

In handling, a right-handed person should operate on the left side and a left-handed person on the right side of the sheep in order to get at the task more expeditiously and with a greater degree of accuracy. In order to keep from disarranging the wool the fingers should be kept together and straight except when grasping the leg to determine its size and firmness, and perhaps when examining the setting of the neck to the head and the shoulders. Only such pressure as is necessary to determine the amount and firmness of flesh and fat should be exerted, and that with the last joints of the fingers. It is not necessary for the judge to pounce on the sheep with all his weight.

It makes no difference whether the examination with the hands begins at the head or the rear of the animal, but the method here described assumes that it starts at the head. The first act is to press down the lower lip with the finger and thumb so that the teeth may be exposed for the purpose of estimating the age. Then look carefully at the head, noting the size of mouth and nostrils, length of face, size and brightness of eyes, the size, shape and color of ears, width of head between eyes and ears, color—whether it conforms to requirements of the breed under consideration. Finally note the general symmetry of the head, and in case it is faulty determine what features cause it to be lacking in this respect. Next examine the neck for smoothness of junction with head and fullness at shoulder. Pass the hand down over the brisket to determine its fullness and its extension in front of the legs. By putting one hand on top of the shoulders and the other on the floor of the brisket an idea can be gained of the depth of chest, which is always desired in considerable degree because it is one important indication of strength of constitution.

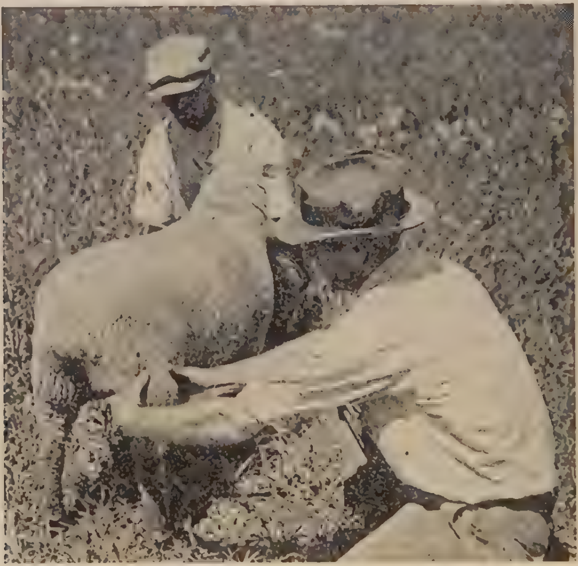

Fig. 166.—Left hand on back of thigh, right hand at rear flank to measure the lower thighs.

In examining the shoulders note how they are covered on the sides and on top. They should be compact; that is, the blades should be laid in well toward each other and the spine should not protrude much above the top edges of the blades, and over the spine and top of blades there should be a covering of flesh and fat. Observe the fullness of heart girth. Using one hand follow along the top of the body from the shoulder to the dock for the purpose of determining fleshing and the strength and straightness of back. In doing so move the hand slightly from side to side in order to determine more accurately the depth and firmness of flesh. Grasp the dock between the fingers and thumb and note its size and fullness at the junction with the body. Figures 166, 167, 168 and 169 give suggestions in handling sheep.

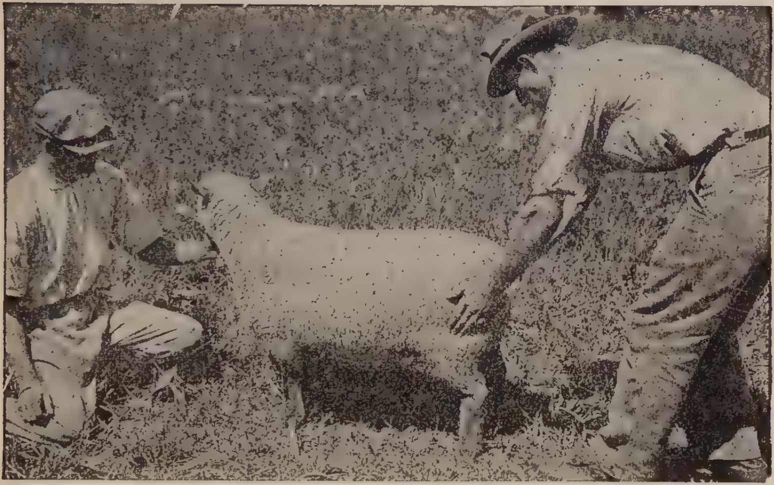

FIG. 167.—Pressing the upper thighs between the hands.

With a hand on either side of the body feel the ribs with a slightly backward-and-forward motion so that the spring of rib and depth and firmness of covering may be determined. The width and depth of loin should then be ascertained either by spanning it with one hand or by placing a hand straight down on either side and noting the depth, and also the width as indicated by the space between the hands.

The examination of the body is concluded by feeling the size and firmness of the outer and inner thighs, the depth and fullness of the twist and by noting the width of rump.

The fleece is examined by carefully parting the wool on the side of the shoulder, the mid-side and the thigh to note its density, length, fineness and color, and the extent to which these factors carry evenly over all of the body.

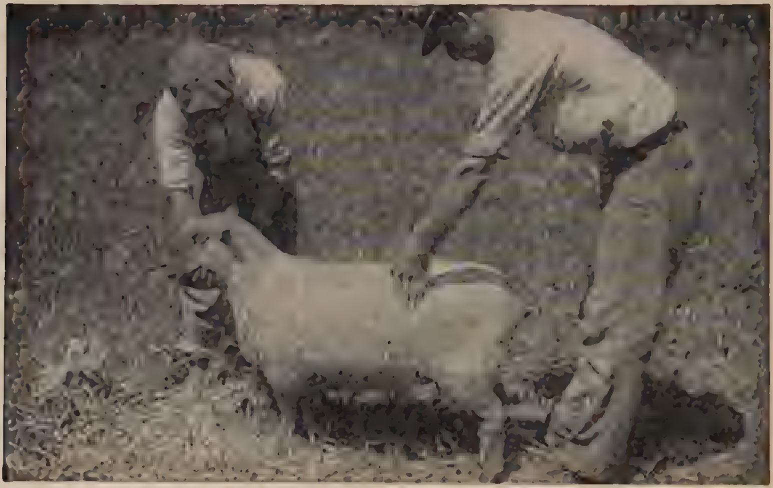

FIG. 168.—Examining the loins for width and depth.

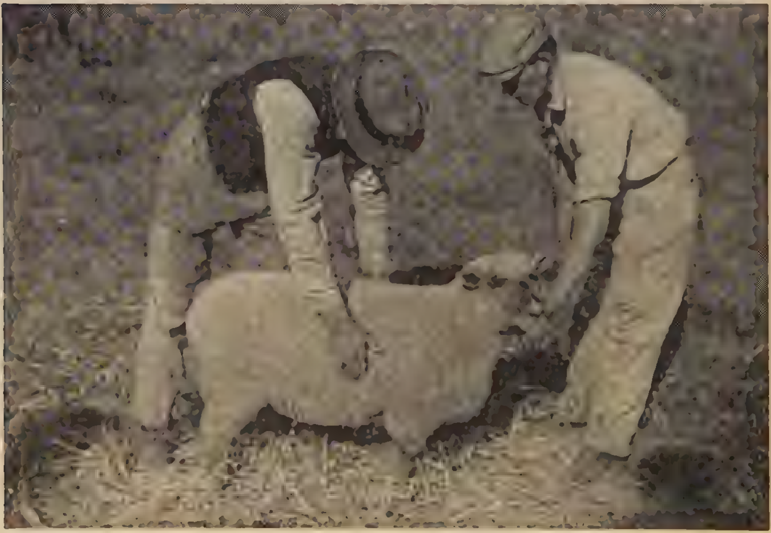

FIG. 169.—Placing the hands on the ribs to determine the depth and firmness of covering.

Estimating Age.—Like man, the sheep has twenty temporary and thirty-two permanent teeth. The eight temporary teeth in the front of the lower jaw are white, short and narrow. The permanent teeth by which they are replaced and upon which age is estimated are longer, broader at the top, and of slightly yellowish tinge. Beginning at the center of the jaw the permanent teeth appear in pairs, the first pair showing up when the animal is about one year old. The next pair, one on each side of the central pair, appear at approximately two years; the third pair at three years, and the fourth at four years. Teeth are really an indication of the degree of maturity rather than of the chronological age of the animal, and if liberal feeding is practised a sheep may have all eight of the permanent teeth before it is four years of age.

Although there are numerous exceptions, many sheep pass the peak of their vigor at five years of age. Their teeth are likely to begin to wear down, and as age advances some of them fall out, making what is called a broken mouth. Broken-mouthed sheep cannot handle feed to advantage and as a rule are not profitable in the flock. Other indications of advanced age are emaciation, sunken appearance over the eyes and a rheumatic condition.

On the markets an indication relied on to a considerable extent is the "break joint," which is the epiphyseal or temporary cartilage just above the ankle. This cartilage is to be found in all immature elongating bones, and its presence in the leg bones of the sheep is proof that the animal is still young enough to possess the flesh qualities characteristic of lamb. Hence the fore leg bones are broken off at the break joint, which amounts to proof that the carcass is from a young animal. Buyers of sheep and lambs on the markets are able to tell whether the bone will break or whether the cartilage has become ossified and hence will not break. They apply this test when the lambs coming to market are almost or quite twelve months old. By the time ewes have become fourteen months of age and wethers eighteen to twenty months ossification has taken place.

Detailed Study in Judging.—Before engaging in a critical study of a sheep one should familiarize himself with the names and locations of its various parts. Out of the experience of capable judges of sheep for breeding and market purposes score cards have been constructed for the purpose of evaluating mathematically the importance of the different parts of the animal. Scoring sheep is not really a method of judgment, but rather a means of study through which one may arrive at an intelligent basis for judgment. The following is a score card used for mutton sheep at the Univesity of Minnesota.

Divisions of the Score Card.—It will be noted that the score card is divided into six general divisions, namely, (1) general appearance, (2) head and neck, (3) forequarters, (4) body, (5) hindquarters and (6) fleece. The descriptions under most of the sub-divisions are sufficiently

Mutton Sheep—Fat Wethers

Scale of Points	Perfect Score	Student Score		Corrected Score	
		1	2	1	2
General Appearance—38 Points:					
1. Weight, score according to age	8	......	......	......	......
2. Form, straight top and underline; deep, broad, lowset, compact, symmetrical, stylish	10	......	......	......	......
3. Quality, hair fine, bone fine but strong; light in offal; yielding large percentage of meat	10	......	......	......	......
4. Condition, deep, even covering of firm flesh over loin, back, ribs, and shoulders; points indicating finished condition: thick dock, thick neck, full purse, full flank, plump breast	10	......	......	......	......
Head and Neck—7 Points:					
5. Head, features clean cut; mouth large; lips thin; nostrils large; eyes large, clear; face short; forehead broad; ears alert, not coarse; fair width between ears	5	......	......	......	......
6. Neck, short, thick, full at junction with shoulder	2	......	......	......	......
Forequarters—9 Points:					
7. Shoulders, covered with flesh; compact on top; smoothly joined with neck and body	7	......	......	......	......
8. Brisket, full in outline, and well extended; breast wide	1	......	......	......	......
9. Legs, straight, short, wide apart, strong; forearm full; bone smooth	1	......	......	......	......
Body—20 Points:					
10. Chest, wide, deep, full	2	......	......	......	......
11. Ribs, well sprung, long, close and thickly covered	4	......	......	......	......
12. Back, broad, straight; thickly and evenly fleshed	6	......	......	......	......
13. Loin, thick, broad, well covered	8	......	......	......	......
Hindquarters—17 Points:					
14. Hips, far apart, level, smooth	1	......	......	......	......
15. Rump, long, level, wide to dock, covered	5	......	......	......	......
16. Thighs, full, deep, wide, fleshed down to hocks	5	......	......	......	......
17. Twist, plump, deep and firm	5	......	......	......	......
18. Legs, straight, short, strong, set well apart; bone smooth; pasterns upright	1	......	......	......	......
Fleece—9 Points:					
19. Quantity, long, dense, even in density and length	3	......	......	......	......
20. Quality, fine, soft, pure; crimp distinct and even throughout fleece	3	......	......	......	......
21. Condition, bright, sound, clean, slight amount of yolk, foreign material not excessive	3	......	......	......	......
TOTAL SCORE	100	......	......	......	......

clear without additional comment, except those under FLEECE and the sub-division WEIGHT under general appearance. Weight varies a great deal because of differences due to age and breed. In summer the weight most desired in lambs of prime form, quality and condition may not be more than sixty-five to seventy pounds, but in winter the lamb weighing eighty-five pounds may sell best. Yearlings most in demand weigh from one hundred to one hundred and ten pounds, but some breeds are so much larger at the yearling age that it would be either illogical to regard them as yearlings or foolish to attempt to score them on the market basis for yearlings.

Under FLEECE the term quality can become clearly understood only after considerable patient practice in judging. *Crimp* refers to the waves in the wool fiber. Generally speaking, the more numerous they are in a given unit of length, say one inch, the finer the fiber. Since fine wool is sought by manufacturers, fineness is usually favorably regarded in all breeds.

Yolk refers to the mixture of sebaceous or oily secretion and the moisture or perspiratory secretion in the wool. There needs to be some of this mixture on the fibers to keep them in proper condition; in fact it is better to have too much than too little, but an excess is useless and essentially represents waste. Foreign material refers to dirt, chaff, burs, etc. It is objected to because it unfavorably affects the color or brightness of the wool, it is often difficult to remove, and it frequently reduces the quality. Burs are especially objectionable, and dirt from chalk and alkali soils causes the wool to be harsh and brittle.

Judging Breeding Sheep.—The problem of judging breeding sheep is that of judging fat or market sheep, especially noting constitution, the characteristics which define breed type, and the sex characteristics known as masculinity and femininity.

Constitution.—Any experienced sheepman very highly prizes health and vigor in his flock. He wants lambs that are strong at birth and ewes that consume and digest feed in such a manner that they have an abundance of milk for their lambs so that they can grow rapidly and develop early into a prime product. If a sheep has a wide, deep chest and a well-extended brisket we usually say that it has a strong constitution, but really the term should mean more than this. It should include vigorous movement, with the head carried well up. The head should be broad between the ears, the eyes large and bright, the mouth large, and the leg bones strong but free from coarseness. To be vigorous and to have strong digestive powers a sheep should have a capacious middle, and especially should it be low and full at the rear flank. Shallowness of body at this point usually indicates lack either of constitution or of thrifty condition.

Breed Type.—Each breed possesses certain characteristics by which it may be distinguished from all other breeds. These characteristics, peculiarly the breed's own, have been selected and fixed by the promoters of the breed. As one would naturally suppose, all mutton breeds have much in common. All wool breeds are alike at many points. The points in which breeds differ most are size; length of legs; length, density and fineness of fleece; shape of head; size and placing of ears; size and color of face, head, legs and skin; fineness of bone; and extension of wool over body, face and legs.

The test of the value of a certain breed in a given locality is not determined solely by the physical characteristics by which it may be recognized from all other breeds, but is rather how well it performs in that locality as a producer of mutton and wool. When a valuable breed is found, however, the sheepman should fully appreciate its characteristics as a breed because all long established breeds selected for a uniform type transmit not only their external body characteristics but also those other characteristics that are of so much importance to the flock master.

Type of Ram or Masculinity.—In the United States sheepmen are coming more and more to realize the importance of using pure-bred rams. Even if a sire is being selected for a grade flock, he should conform fairly closely to the type considered standard for his breed. But in no case should mutton type, if mutton production is to be the chief consideration, be overlooked. Rather than sacrifice in this respect it would be better to accept some defects in breed characteristics.

Every ram should be strong in those features which denote constitution. The importance of vigor in the male cannot be over-emphasized. His head should be short and broad, his nose just above the nostrils wide, and his neck should be short, thick and full at the shoulders. His flesh should be deep and firm, his action bold. He should be strong on his legs; a ram with weak pasterns should always be avoided.

Type of Ewe or Femininity.—If a ewe of a certain breed is being selected she should conform to breed type. She should be more refined in features than the ram, but not over-refined. Her neck should be somewhat more slender. But her body should be deep, wide and indicative of strong digestive capacity. Roominess is a good term to apply to her middle. She should be wide in the rump, as this conformation indicates strong breeding and suckling powers. Every ewe should be sound in mouth and in udder.

Flock Type.—Uniformity with respect to form, fleece and vigor should be sought in the flock. Barren ewes, broken-down ewes, and ewes radically different in type from the average in the flock should be discarded. Special care should be exercised in selecting breeding rams and with a view to building up a breeding flock composed of ewes of uniform excellence.

Success in mutton and wool production is dependent mainly upon (a) skilful selection of animals for the purposes suitable to the location

(b) adequate feeding and care with a minimum of overhead expense, (c) turning the products into the best available markets at the proper time.

Suiting Type to Enterprise.—In selecting breeding stock the first thing to determine is the kind of mutton and wool production to undertake. This depends on the location with respect to markets and on the kind and amount of land at one's disposal. Special production, such as fancy lambs out of season, should not be attempted except by those already skilled in lamb raising and located near a city where there is sure to be a strong demand for the product. Wool production as a chief consideration cannot have preference over lamb and wool production in farm-land regions within easy reach of the general markets. If one has a large tract of land ill adapted to grain production but fairly good for grass, more emphasis would logically be given to wool than on land where good grain crops are grown. In most locations in the United States one would wish to select breeding stock that is capable of producing prime lambs for the general market and wool that is in good demand, but not necessarily in highest demand. In other words, both the mutton and wool products need to receive consideration in most instances.

Vigor.—Health and vigor need to be emphasized in breeding stock not only when the flock is being established but throughout the period during which it is maintained. While correct mutton form is important if one is to produce market lambs, health, vigor, efficient digestive powers, deep milking qualities, prolificacy and strong maternal instinct are even more important in the ewe flock. "Every ewe an efficient producer of lambs and wool," should be the motto of the practical flock master. No matter how splendid they look, there should be no hesitation in eliminating ewes that are irregular and unreliable as producers, for in their idleness they tremendously increase the cost of maintaining the flock in proportion to returns. Uniformity and soundness in flocks should always be emphasized. The flock owner should be not only a capable but a critical judge as regards his own flock. Often men fail to make their flocks pay because they do not know how well the various individuals in it are performing. If the ewe flock is to be replenished from its own ewe lambs, care should be taken to select lambs from the best producing females.

Job 4. Planning Barns, Shelters and Equipment

Conditions Usually Found.—(1) Experienced sheepmen seldom make serious mistakes regarding shelters, lots, and fencing. (2) A few build barns too expensive for economical returns. (3) A few locate the sheep quarters badly.

Aims.—(1) Young farmers should learn to calculate the costs of fencing, shelters, and other equipment for the sheep enterprise. (2) They should learn to plan suitable and economical quarters for sheep.

Problems for Study and Discussion.—(1) Visit farms to study shelters and equipment for sheep.

2. Compare local barns and equipment in economy of construction and suitability to purpose.
3. Choose the form of barn or shed which you prefer and which you could best afford to build.
4. Calculate the entire cost of a suitable farm layout for sheep, including shelters, lots, pasture fencing and small equipment.
5. What equipment is needed at lambing time?
6. What equipment is needed for shearing and caring for fleeces?
7. Describe good locations for sheep sheds.
8. Describe good feeding racks and feeding troughs.

Activities.—(1) Draw plans of a good winter barn for a cold region. (2) Make a list of lumber needed for building a sheep shed and calculate the cost of materials.

Things to Make.—(1) Make sheep hurdles for aid in showing sheep at fairs. (2) Make a shearing platform. (3) Make hinged panels for lambing pens. (4) Build a lamb creep for use at home.

Shelter for Sheep.—In nearly all locations the flock will need shelter at certain times. Cold rains, wet resting places, and resting places unprotected from the hot sun are all hard on sheep. Lambs born in cold weather need warm shelter for a few days.

Because they are likely to be injured, sheep should not be sheltered with large animals such as cattle and horses and it is seldom advisable to have them share shelter with hogs. When the ewes are lambing they must not be permitted to be with hogs, as a hog will greedily devour a new-born lamb.

Sheep shelter need not be expensive, as the main consideration is protection from wet weather. Good ventilation is very important. If the ventilation is good, the individuals will stand a fair degree of crowding except when lambing approaches. Ewes heavy in lamb and ewes with new-born lambs need about sixteen square feet of floor space each.

Racks and Troughs.—Barns and sheds for sheep should be equipped with good racks and troughs so designed that the feed can be kept clean and consumed without unnecessary waste. Hay racks should be built so that the chaff from the roughage will not fall into the wool on the necks and backs of the sheep. Since sheep are comparatively light animals it is not necessary to build the racks, troughs, and partitions of heavy material. Movable partitions, racks, and troughs are often best, as they permit of adapting the floor space to the particular needs of the flock.

Economical Equipment.—Very little should be expended for buildings for sheep. Economy in this matter should be carefully considered by the beginner. Expensive barns should never be built by a man just entering upon this enterprise. Especially warm quarters are not necessary. Single walls will give ample protection in nearly all kinds of weather. If lambing time occurs during cold weather, a warm room can easily be arranged in one section or corner of the barn. It is unnecessary to build a permanent barn for this when only a few days of special protection are required.

Location.—Sheep buildings should be located on dry, well-drained ground where there are no obstructions to sunlight and air drainage is good. A southern slope having the possibilities of a bank shed serves as an excellent building site. The ground to be converted into lots about the building should also be dry and well-drained, for dry footing is one of the essentials to the health of sheep.

If possible, the barn or shed should be located only a short distance from at least a part of the area that is to be used as pasture or forage for the flock. This will permit of the shed being used throughout the year, and the shed is a much more convenient place than the fields for feeding grain to the lambs in late spring and in summer. In order to economize time in caring for the flock the sheep shed should be located near the other farm barns, provided this can be done without sacrificing the other important factors mentioned above. If only a shed is erected, it will be necessary for the sake of convenience to locate it near buildings where winter feed is stored.

Fences.—If possible, sheep should be protected by boundary fences that will exclude dogs. (It is doubtful whether any fence is absolutely dog-proof.) The fence of woven wire having a barbed wire close to the ground and three barbed wires at the top will be found proof against most dogs. Division fences thirty-six inches high and made of woven wire are adequate for keeping most sheep in place. These fences may be either temporary or permanent in nature, or the temporary fence may be made of wooden panels.

A Lamb Creep.—This is a device that admits the lambs to a feeding place but excludes the older sheep. Its construction should be a very simple matter. Provision should be made for adjusting the size of the openings for the lambs, and as a rule there should not be more than two or three places for admitting them.

Temporary Pens.—Lambing pens are almost indispensable to successful lambing, and the movable type is the more convenient to use. Since they are to be moved from place to place, they are best if made of light boards, preferably pine seven-eights inch by three inches, planed on both sides. The pens consist of two four-foot panels or hurdles hinged together. Opening these panels at right angles in a corner of the barn where the free ends may be fastened to walls makes a pen four feet square, which provides sufficient space for the average-sized ewe and her lambs.

Job 5. Planning Rotations and Pastures

Conditions Usually Found.—(1) Beginners are likely to make mistakes by not properly planning pastures and suitable rotations. (2) The best sheepmen seldom make serious mistakes along these lines. (3) Sometimes serious losses occur because of improper planning of pastures.

Aims.—(1) The value of good plans for pastures and cropping systems on sheep farms should be understood. (2) Students should make suitable plans for these.

Problems for Study and Discussion.—(1) Ask the best sheep growers why sheep should be moved from one pasture to another, and how often.

2. How many pasture fields are used for farm flocks?
3. What crops are grown locally for pasturage? In permanent pastures? In temporary pastures?
4. What hay and grain crops are grown on sheep farms of your region?
5. Write out the rotations followed by the best farmers.
6. What grains are most commonly purchased by local sheepmen?
7. Why are supplementary feeds necessary?
8. Calculate from the sizes of pastures and numbers of sheep kept what areas you would need in your pastures in rainy seasons. In dry seasons.

Activities.—(1) Draw a plan of your farm or a neighbor's place, showing an ideal arrangement of pastures and fields for crops. (2) Write on each field the rotation system to be followed. (3) Collect specimens of the different pasture grasses, clovers and other pasture plants. (4) Preserve these for future study. (5) Collect weeds which bear burs, and study their methods of clinging to the wool of sheep. (6) Label each kind of weed.

Value of Pastures.—Generally speaking, the cost of maintaining the flock is reduced by shortening the period of feeding in the dry lot as much as possible. In forage lots and pastures sheep gather their feed, which saves the expense of harvesting, storing and feeding. Moreover, the grasses and other green feed are natural to sheep; their digestive systems function best when they are available. It is better both for the sheep and the pasture or forage, however, to delay grazing until the plants are large enough to contain a substantial amount of nutrients and their root systems are strong enough to renew growth at a fairly rapid rate. Fall-sown rye fields make good green feed to be used before the regular grazing season arrives. Since it is not a permanent pasture it is permissible to put the sheep on it while the plants are comparatively short. In fact, rye is not very palatable after it becomes four or more inches high. In warmer climates, fall-sown oats make splendid early spring feed.

Blue-Grass.—Of all the grasses used for pasture in the United States, blue-grass is the most common. At the beginning of the grazing season it possesses wonderful feeding powers for sheep. It is palatable, it increases the milk flow of ewes, and it produces a satisfactory rate of growth in lambs. The criticisms of it are that it is too dry by midsummer in many regions to be good feed, and since it is a permanent pasture grass, it is likely to become badly infested with parasites very injurious to sheep. White clover is often grown with blue-grass, and this combination makes ideal pasture. (Fig. 170).

Timothy makes splendid sheep pasture early in spring, but it, too, lasts only a short period; and close grazing is very injurious to it, because the leaves grow from bulbs which the sheep will eat when grazing becomes close.

Leguminous Crops.—Sheepmen are coming to place considerable reliance on leguminous crops for green feed. Red clover, alsike, and sweet clover make good summer feed although sweet clover is not very palatable. Alfalfa is palatable, but it is likely to cause losses from bloat if pastured too much at first.

Rape.—This is a good forage for sheep, and all sheepmen located where it can be successfully grown would do well to have at least a small area of it to supplement the pastures and other forage.

Importance of Green Feed.—In growing lambs the main point to keep in mind is, that ewes and lambs should have some green feed as soon as a substantial growth is available and should continue to have good green feed of some sort until the lambs are ready for market. All through the period of their existence, from the time they will eat until they are ready for disposal, the lambs should have grain. The grass lamb fed grain makes a better meat product than the grass lamb given no grain.

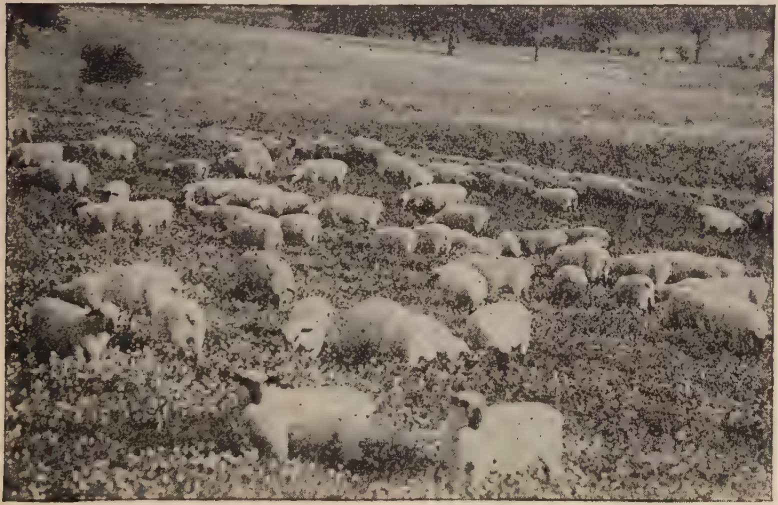

Fig. 170.—White clover and blue-grass make a good mixture for lambs in pasture. (J. C. Allen.)

Permanent Pastures.—Permanent pastures are old standbys which nothing else can completely replace as convenient feeding grounds, for they can be, and usually are, made use of in every month of the year. Their worst feature lies in the fact that parasites harmful to sheep accumulate in them. In many instances they become so badly infested as to be almost useless. Fortunately there are permanent pastures in regions where sheep parasites are to be found, that for some reason do not become badly infested. Sheep thrive on them year after year.

On the other hand, annual forage crops and such crops as clover and alfalfa are by no means parasite-proof, but if they are in a rotation system of cultivation, the chances are that they will not become so badly infested as permanent pastures.

Permanent pastures can be divided so as to allow a movement of the flock to new grazing every two weeks, if justified by profits. If watering facilities are present, this requires only the expense of the division fences. (See Job 9). (Fig. 171).

Rotations for Sheep Farms.—Sheep should not be kept on a farm which does not produce the crops for feeding the flock. The farm rotations should be adapted to the sheep enterprise. Enough small-grain or other crops should be planned to provide pastures in the mild weather of fall, winter and spring. Enough grain should be grown to feed the flock well. In the central states the most common farm rotation where sheep are kept is (a) corn; (b) small grain; (c) clover; (d) grass. Besides this main rotation, pastures either temporary or permanent or of both types are provided.

Job 6. Feeding the Flock

Conditions Usually Found.—(1) The most careful farmers are the most successful in sheep feeding. (2) Beginners and careless feeders are likely to cause serious losses.

Aims.—(1) Feeding problems should be thoroughly understood by beginners. (2) Economical features of feeding to get the best results should be studied.

Problems for Study and Discussion.—(1) What feeds are used for growing lambs in your region?

2. Talk with sheep farmers regarding the rations for breeding ewes. For fattening lambs. For others.
3. Study summer feeds for different classes of sheep.
4. What are good winter rations for stock kept over?
5. Compare different forms of roughage for sheep.
6. Compare the different grains for lambs. For fattening stock. For ewes.
7. Discuss ensilage and root crops for sheep of different classes.
8. Describe feeding practices as to quantity, frequency and places of feeding.

Activities.—(1) Practise mixing grain rations for (a) use in a lamb creep; (b) breeding ewes; (c) fattening wethers. (2) Make a chart showing the composition of each of the different types of rations.

Feeding and Care.—Good animals require an adequate amount of feed. In livestock improvement, it has never been an object to select animals with small consuming powers, but rather the opposite. It has been found that, although animals with strong digestive systems consume relatively large quantities of feed, they convert the feed into valuable products more economically than do animals of small consuming capacity.

It is well to remember that the sheep is a ruminant and hence adapted to the consumption of roughages. It is even better adapted to feeding on grass, forage, and hay than is the cow. Therefore, in preparing to keep sheep one should look well toward providing a sufficient supply of grass and other roughage. But there should also be a supply of such grains as corn, oats and barley. The amount of grain needed will not be large but it is essential to success. As regards both roughage and grain it is far more economical to have a little too much than not enough. The secret of good feeding is to supply the flock with the kind and amount of feed needed to keep it in thrifty condition and producing efficiently for the ends in view. There can be as much waste in over-feeding as in under-feeding, or more. And the needs of the flock in one season of the year may be very different from its needs in another.

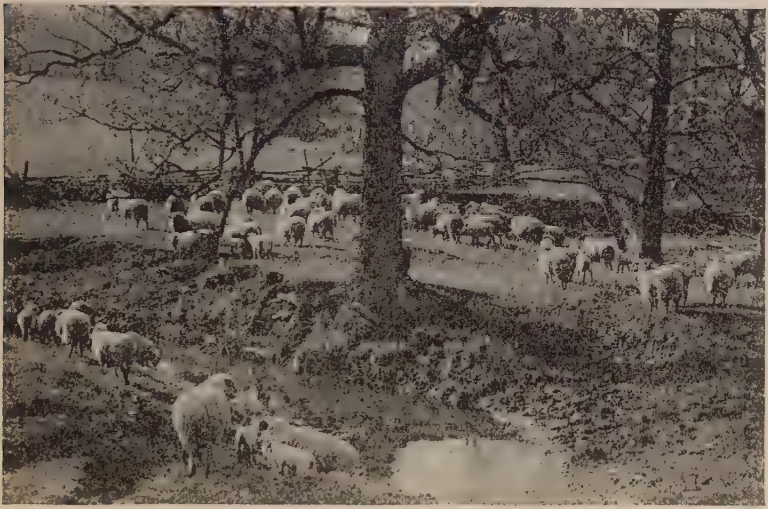

FIG. 171.—A fine combination for old and young, grass, ample shade, cool, running water.

Feeding and Care During the Breeding Season.—As a rule, late summer and autumn months are regarded as the breeding season for sheep in this country. The period of pregnancy for ewes is approximately 147 days or nearly five months. In organizing his sheep enterprise the owner should determine when he desires his lambs to come and govern the beginning of the breeding season accordingly. If it is desired that the lambs begin coming about the first of March the ram should be placed with the ewes near the first of October.

It is best for all the ewes in the flock to become in lamb in as short a period as possible after the breeding season begins. Whether or not this will happen depends on the evenness of the ewes in condition and thrift and on the vigor and activity of the ram. If the breeding season is extended over a long period, the lambs will be so uneven in age that it will not be possible to get them all ready for market at the same time. Moreover, one has to give special attention and care to the flock during the lambing period and hence it should be confined to a relatively short period.

Conditioning the Ewes.—At the close of the suckling period breeding ewes are usually reduced to a thin condition of flesh. For a time after the lambs are sold or weaned ewes should be kept on rather scanty rations in order to discourage the secretion of milk. For a time after the lambs are taken away it may be necessary to milk some of the ewes to prevent their udders from spoiling. This is a time-consuming process which is not pleasant, and hence the flock should be handled with a view to drying them off as soon as possible. But when the ram is turned with the ewes they should be on feed that will cause them to be gaining in weight, because they will come "in heat" more readily if this is the case. The term "in heat" refers to the *œstrus* period, in which the ewe is in such condition that she will mate with the ram. It is at this time that the female germ cells, the ova, are secreted. In sheep, the œstrus period recurs about every sixteen days.

One of the best feeds during the breeding season is good grass pasture where good water is available. About two weeks before the breeding season is to begin it is well to feed the ewes a little grain, such as a fourth to a half pound of oats per head daily. This will stimulate them to come in heat soon after the beginning of the breeding season.

Conditioning the Ram.—The ram should be in good condition, but not fat, at the beginning of the breeding season. About two weeks before, he should begin to receive some grain, and he should continue to have it daily until the breeding season is over. The amount he should receive will depend in part upon his size, but in general about a pound per day will be sufficient. Oats, or oats and corn in equal parts, constitute a good ration. Other grains may be used if they are more readily available. As a rule, one ram to thirty-five or fifty ewes is sufficient. In case the ram is subjected to very heavy service it may be advisable to remove him from the flock through the day or night, at which time he may be fed liberally.

It is good practice to smear a water-soluble paint on the floor of the brisket of the ram each day during the breeding season so that he may mark the ewes with which he mates. In this way one can tell which ewes have been bred and how rapidly the breeding process is proceeding. It is also well to see that dung tags or any other obstructions to mating be removed from the ewes before the breeding season begins.

While the weather is yet warm the entire flock should be carefully inspected for such external parasites as ticks, lice and scab mites. If any are found, the flock should be dipped in some well-known solution for exterminating such parasites. It is not advisable to dip sheep in cold weather. A few parasites present in the fall will multiply into a devastating horde by the time the lambs are to arrive. The lamb is especially attractive to these parasites and they can greatly retard its growth. In fact, it is well as a precautionary measure to dip the flock in late summer or early autumn even if no parasites can be found.

Caring for Ewes Through Pregnancy.—Ewes should be gaining in weight through the period of pregnancy. From the time their lambs are weaned until the time of birth of the next lamb crop they should gain as much as they will lose in giving birth to their lambs and suckling them to weaning time. A ewe in thin condition at the time her lamb is born cannot suckle it successfully without the consumption of an unusual amount of feed and an extra drain on her vitality. This extra feed is usually more expensive than the feed that would have put her in proper condition during the period of pregnancy.

It is well to have ewes continue on pasture as long as possible after they are bred. The exercise and living in the open are good for them provided they are well fed. All through the pregnant period it is best to have ewes out of doors as much as possible but in order to avoid colds and sore feet they should be sheltered from cold rains, and they should not be forced to lie or exercise in deep mud.

On most farms there is a considerable amount of feed in the fields which sheep can consume in the fall and early winter. Beside the pastures, there may be stubble and stalk fields and feed along the fences. Such feed is very cheap, and unless used by the flock would probably be wasted. Such sources of feed may not be wholly sufficient, but by using them and supplementing with a little stored grain and hay the flock thrives and is maintained at low cost.

As the period of pregnancy advances, it may be advisable, especially if the flock is large, to separate the thinner ewes from the main flock and give them special treatment in order to have them in proper condition by lambing time.

During the last six weeks of pregnancy the flock should not be subjected to strenuous exercise as the ewes are becoming clumsy and cannot move rapidly with ease. Driving with a dog that is inclined to rush them is especially objectionable. It is always injurious to sheep to have them attacked by dogs, but the worst possible time for an attack is when the ewes are heavy in lamb. The result is death of some ewes, abortions, and abnormal lambs.

The shelter for pregnant ewes should keep them dry and furnish them with a comfortable resting place. It should be well ventilated, but warmth can be left out of consideration because the wool on the ewes is adequate protection against the cold.

If ewes enter the winter in good health and flesh, it should be possible to carry them to lambing with little or no grain. But it will be necessary to feed roughage such as clover and alfalfa hay, well-cured corn fodder and corn silage. It is advisable and safe to feed as much of these roughages as the ewes will clean up well. Corn silage fed in moderation, that is, to the extent of one to two pounds per head daily, is an excellent succulent feed; but no frozen or spoiled silage should be used as it is likely to cause losses and digestive troubles. Too much silage may cause weak lambs.

It should be the plan of the sheep owner to furnish only feed of good quality to his flock. If there is some spoiled or partly spoiled feed mixed in with the good, it is better to let the sheep waste most or quite all of the bad rather than force them to eat it.

Grass serves to keep the digestive tract of sheep in good order, hence they are likely to suffer from constipation when they are removed from pasture. Good silage, or roots such as mangels or rutabagas, will help to prevent this trouble. If none of these can be had, one-eighth pound linseed meal, which is a laxative, should be fed with about one-half pound of grain.

If the ewes' backs and ribs are not well covered over with flesh and fat as the lambing period approaches, the owner should not hesitate to supplement the roughages with grain. The amount fed daily per head should be approximately one-half pound in the beginning and increased to about a pound. Any of the feeding grains, or good mill feeds may be used. Corn as a sole grain feed is a little too heavy for sheep, but it can be used successfully if not given in excessive amounts and if it is supplemented by good leguminous roughages such as clover and alfalfa. Oats and wheat bran constitute an excellent concentrate ration for ewes as lambing approaches, as they supply the elements needed by the fetus at this time.

Experimental trials have determined dry-lot rations for pregnant and for suckling ewes. For pregnant ewes, U. S. Farmers' Bulletin 840 gives the following for ewes weighing 120 to 145 pounds.

RATION I

	Pounds
Alfalfa hay	2
Corn silage	2
Shelled corn	0.5

RATION II

	Pounds
Oat straw	1
Corn silage	2
Linseed meal	0.25
Corn	0.5

Feed in Racks.—Sheep may be fed either on the ground or from racks. Even though the cost of constructing racks may be high, it usually pays to provide them as the amount of feed wasted by feeding on the ground is considerable except in the case of coarse roughage such as corn fodder. If there is a dry place, it is good practice to scatter corn fodder over a considerable distance for ewes advanced in pregnancy, as this induces them to take the proper amount of gentle exercise.

Salt and Good Water.—These should always be available to pregnant ewes, in fact to the flock at all times. It is not uncommon for pregnant ewes to become dull and listless and refuse to eat. The affected animals should be given one-half pound each of epsom salts dissolved in lukewarm water. As soon as they will eat they should be given the very best of feed, such as alfalfa hay, oats, and linseed meal. Succulent feed such as silage, roots, and rye pasture help to prevent this trouble.

Commercial Sheep Feeding.—Reference is here made to the purchase of western sheep and lambs for the purpose of fattening them for the market. This practice, which has become very general in the Middle West and is followed at a few points in the Far West, is conducted under many different methods. In middle-western states the majority of farmers who feed western sheep or lambs purchase them in September or early October and turn them into pastures or into forage or corn fields. In fact it is not uncommon to give them the run of almost the entire farm. This is a cleaning up process in which weeds are disposed of and good gains are made on very cheap feed. Often rape and soybeans are seeded in corn fields in order to provide a variety of feed and more forage. A part or nearly all of the corn crop may be harvested by the sheep. Sometimes the whole fattening process is conducted in the fields. At other times the first half of a sixty- or ninety-day feeding period is conducted in the fields and the second half in the dry lot with such feeds as corn, silage, and legume hay. There are not a few cases where the whole feeding process is carried on in dry lots. (Fig. 172).

Feeder lambs are much more popular than feeder sheep. More of them are available and they are, as a rule, more reliable. They weigh at the time of purchase all the way from fifty-five to seventy-five pounds.

The length of the feeding period depends on the weight and condition of the animals when started on feed. A good practice is to purchase more than one carload if sufficient feed is available, in order that the larger and fatter lambs can be marketed before the smaller and thinner ones are ready to go. Men who purchase several carloads may begin marketing within a month after purchasing and continue for a hundred days or more.

Some follow the practice of buying lambs as late as January and February, at which time they may shear them. This permits of keeping more lambs under a given amount of shelter, and it is thought that they eat more and gain faster than they would were they to be left in their wool. Late-season feeding is conducted successfully, however, without shearing. All late-season feeding in the middle-western and eastern sections should be conducted under shelter.

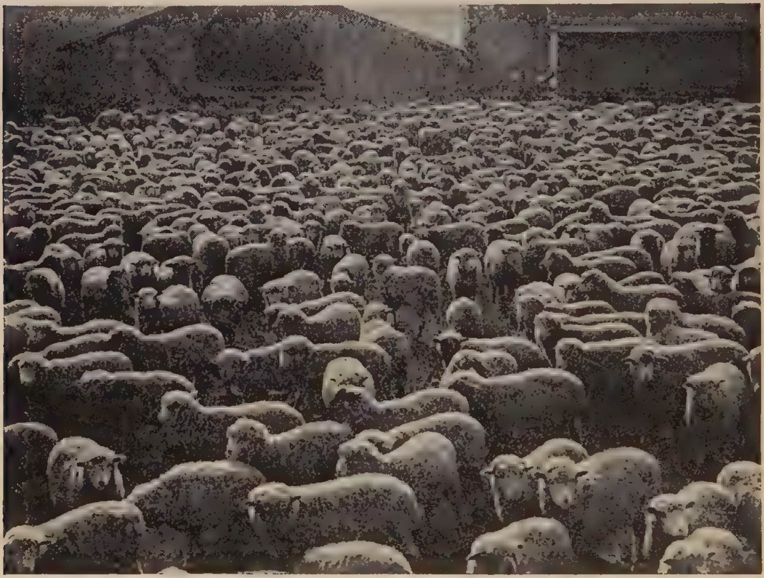

FIG. 172.—Western range lambs in a corn-belt feed lot. A winter feeding project.

Job 7. Managing at Lambing Time

Conditions Usually Found.—(1) Many preventable losses occur at lambing time. (2) The best sheep farmers are able to control losses at lambing time by proper care.

Aims.—(1) Students and farmers should know what losses are likely to occur at lambing time. (2) They should learn how to prevent all these losses.

Problems for Study and Discussion.—(1) Ask a good herdsman to describe the care he gives his flock at lambing time.

2. Find the number of lambs dropped and the number raised on each local farm last season.
3. Calculate the percentage of perfection in each case.
4. Ask herdsmen how ewes are made to own their own lambs or strange lambs.
5. What special care should be given weak or chilled lambs?
6. For what reasons would you transfer lambs from one mother to another?
7. How can lambs be kept from being lost from their mothers?
8. Describe good lambing quarters.
9. Discuss lambing dates for your region.

Activities.—(1) Practise skinning a dead lamb. (2) Practise feeding an orphan lamb. (3) Try making an ewe adopt a strange lamb. (4) Try warming a lamb which has been chilled. (5) Teach a lamb to nurse.

The Lambing Season.—There can be no success in the sheep enterprise if the lamb crop is poor. Hence the owner should do all he can to save his lambs and to get them to thriving and growing at once. He should record the date of turning the ram with the ewes in order that he may know when to expect the first lambs and he should be fully prepared for them a few days before they are expected, as a few may be born prematurely.

The Lambing Quarters.—These should be warm and dry, but adequately ventilated. They should be arranged to permit the lambs to be in the direct sunshine as much as possible so that they may have the advantage of the ultra-violet light rays.

Lambing quarters should not be cramped—the ewes should have plenty of room; otherwise the lambs are likely to be injured by trampling. Sixteen square feet per ewe should be adequate. A number of lambing pens consisting of two panels, each four feet long, should be provided. These can be set up along the side of the barn or shed. If the ewe is placed in one of these pens just before or just after she lambs, she is alone with her offspring and can give it adequate attention without being disturbed by the other members of the flock, and her lamb or lambs cannot stray away from her. Usually after two days she can be placed with other ewes and lambs.

Difficult Lambing.—The ewe should be carefully watched while she is giving birth to her lamb. If conditions are normal she should not be disturbed, but often she must be assisted. The normal presentation of the lamb in parturition is with its fore feet, with the nose placed on them, presented first. Sometimes the breech comes first and the ewe may be able to make the delivery without assistance, but she cannot do so if the lamb's head is turned back over its shoulders, or if a leg is drawn out of normal position, or if the back is presented first. In case of such difficulties the shepherd should smear his hands with a good disinfected oil and a hand should be inserted for the purpose of getting the lamb in normal position if possible. If this can be done, the birth can usually be accomplished without much further difficulty. Occasionally the lamb is in normal position, but too big for the ewe to deliver without assistance. The shepherd should then get a firm hold on the feet of the lamb and pull steadily outward and downward until the lamb is delivered. As soon as the lamb is born the shepherd should remove any membranous material that may be over the lamb's nostrils, to allow its breathing. In normal parturition the ewe gives the lamb immediate attention in this respect, but when she must be assisted she may be too nearly exhausted to rise for several minutes.

The First Nursing.—For a time after the lamb is born, the ewe should be watched but not disturbed. If her maternal instinct is normal she will stimulate the lamb by licking the fluids from the body coat. If the lamb is normal it will be on its feet in a few minutes searching for its mother's udder, as it is born hungry and should have some of its mother's milk as soon as possible. The shepherd should see to it that it is fed. If the ewe and the lamb cannot manage, he should give assistance by backing the ewe into a corner and gently pushing the lamb to the udder by keeping his hand on its rump. After the lamb has once found the teat it seldom needs further help in suckling.

Disowned Lambs.—Ewes are sometimes lacking in maternal instinct and refuse to own their lambs. This is most likely to occur with young ewes having their first lambs. In the case of such a ewe, the shepherd should do all he can to awaken her mother instinct. In all cases the ewe knows her lamb through the sense of smell. Many cases have been cured through awakening this channel of recognition. Sometimes it is done by smearing some of the ewe's milk on the lamb's rump and on her nose, or by rubbing the lamb and the ewe's nose with a cloth having kerosene or sassafras tea on it. Perhaps any other strong-smelling liquid would serve the purpose equally well. Still other devices have been used with success.

Owning Other Lambs.—Some of the above devices are employed in getting a ewe to take a lamb not her own. It sometimes happens that a strong ewe with plenty of milk loses her lamb and some other ewe has twins or triplets. It is better if one of these lambs can be transferred to the ewe without offspring. It is accomplished most easily by skinning her lamb as soon as it is dead and tying its skin on the lamb to be transferred. After a few days this skin may be removed.

The Lamb's Bowels.—For several days after the lamb is born the shepherd should keep both the lamb and ewe under observation. The first feces cast by the lamb are very sticky, and they sometimes cling to the wool on the tail so that the anal opening is closed. The sticky deposit can be removed with a stick or corn cob. Little lambs sometimes become constipated. One of the best correctives is a tablespoon of castor oil.

Care of the Mother.—In the case of the mother one should be sure that she casts the placenta (afterbirth) and that her bowels and udder are in good condition. For the first month or so after lambing, udder troubles are likely to arise. Pock-like sores caused by bacterial infection may make the teats and udder so sore that the ewe will not permit the lamb to nurse. They should be treated with a good disinfectant. Sometimes the lamb's teeth are sharp and cause the udder to become sore. Soon after lambing the udder may become inflamed and very sore. This trouble, known as garget, is ascribed to several causes, among them inability of the lamb to take all the milk, exposure of the udder to cold, and lying on wet ground. It is difficult to treat. As soon as it is discovered the udder should be thoroughly milked out and treated with warm compacts soaked in a solution consisting of one tablespoon each of lead acetate, zinc sulfate, and boric acid in a quart of water. If the swollen part is not feverish it can be reduced by rubbing twice daily with tincture of iodine.

Orphan Lambs.—Occasionally there will be orphan lambs in the flock. The fewer the better. There seems to be no one best prescription for their upbringing. At first the orphan lamb should be given some ewe's milk if possible. This can be supplemented by good cow's milk fed from a bottle through a nipple. Especial care should be exercised in sterilizing the bottle and nipple and in feeding the milk at about 100 degrees F. The way to warm the milk is to place the bottle containing it in warm water.

Job 8. Growing the Young Stock

Conditions Usually Found.—(1) Good shepherds know many points in management which contribute to their success with sheep. (2) Neglect and bad management often cause serious losses.

Aims.—Beginners should learn many points in good management to avoid serious losses.

Problems for Study and Discussion.—(1) How many of the local sheep farmers practise docking and castrating of young lambs intended for market?

2. Describe the best economical lamb creep for feeding suckling lambs.
3. Describe good methods of weaning lambs.
4. What sorting of lambs should be done after weaning?
5. Discuss the importance of shelter and shade in summer.
6. What care should be given to the ewes after lambs are weaned?
7. Into what groups are sheep flocks sorted during winter?
8. Describe good management to prevent stomach worms.
9. Make a calendar program for your region as a guide in forcing early lambs.
10. Ask growers what special management is required for the production of early spring lambs.
11. Calculate the date for breeding ewes which are to bring early spring lambs.
12. At what age should early lambs be ready for market?
13. What weights of early lambs are demanded for top prices?
14. Describe the finish of early lambs demanded for top prices.
15. Show the relation of docking and castrating to prices received for lambs.

Activities.—(1) Teach lambs how to use lamb creeps which you have built. (2) Practise docking lambs. (3) Under the direction of an experienced person castrate a number of lambs.

Feeding Suckling Ewes.—The younger the lamb, the greater its ability to convert its feed into body tissues. It pays, therefore, to keep it growing from the time of birth. This can be accomplished at first only through its mother. As soon as she has recovered from parturition, which requires only a day or two, she should be fed liberally so that she will yield the maximum quantity of milk. If she has not been receiving grain, it should be given in small amounts at first, and gradually increased. A grain mixture is better than only one kind of grain because it is more likely to furnish all the elements needed for body requirements and milk secretion. At first it will be best to feed about one-half pound per day of concentrate consisting of one part wheat bran and four parts oats, by weight. Within a week other concentrates, such as corn and linseed meal, can be introduced. The total amount of concentrates that should be fed depends on the size of the ewes, their condition at lambing, the time of lambing, whether or not they are suckling twins, and the kind of roughage they are getting. In large flocks the ewes with twins should be separated from those with singles in order that they may be given more feed.

The best roughages for suckling ewes are leguminous hays such as alfalfa, red clover, cowpea, soybean; and good corn silage. Roots, such as rutabagas and mangels, are excellent for ewes with lambs at side. If the supply of leguminous roughage is very limited and main dependence has to be placed on grass hay, straw, corn fodder, or silage, the amount of nitrogenous concentrates will need to be increased, because protein is essential to the milk-making process.

Stored grain and roughage should be fed to the ewes until the pastures become so luxuriant that it is very evident additional feeds are no longer needed.

Abrupt changes in the rations of breeding ewes should be avoided, as they easily affect both the ewes and their lambs. The animals do best when continually given the same well-balanced ration. Sheep enjoy a variety of feed, but not necessarily as defined by abrupt change from one feed to another.

In trials the Illinois Station measured the consumption of feed and water for a period of fifty-six days by two-year-old and three-year-old western ewes confined to dry lot and suckling lambs. These ewes weighed 130 pounds.

Ration Number 19

		Pounds
Grain	Linseed meal....1 part Corn...........3 parts Oats...........6 parts	1.0
Alfalfa hay		4.0
Water		14.0

Ration Number 20

		Pounds
Grain	Linseed meal....1 part Corn...........3 parts Oats...........6 parts	1.0
Corn silage		4.0
Alfalfa hay		2.0
Water		12.0

Growing the Lambs for Market.—As a rule the farm-grown lamb should be handled so that it is ready for market by the time it is

3½ to 5 months old. Lambs born in cold weather should remain in warm quarters until they are at least ten days old. Even then they should not be placed where they must endure the more severe phases of cold and unfavorable weather. They will not grow satisfactorily if they are uncomfortably cold. As in the early days of their life they should be allowed to avail themselves of the direct sunshine.

Young lambs as well as older sheep should have good dry bedding. That this is a requirement for young lambs is indicated by the fact that they often sleep in the soft, warm wool on their mother's backs.

Using a Lamb Creep.—Lambs being grown for market on farms should have grain as soon as they will eat it. As a rule they will begin to eat when they are about two weeks old. They should have a place to feed apart from the ewes. Their inclination to eat will be encouraged if this place, known as a creep (Fig. 173), is located in a dry sunny place where the lambs will like to play and sleep. Troughs, so constructed that the lambs cannot lie or stand in them and thus foul the feed, should be provided for the grain and racks should be built for hay. At first the feed should be ground, but after the lambs are five or six weeks old whole grain is better. The first grain fed should be made as appetizing as possible. If it is of first quality and kept clean it will be but a short time until the older lambs begin eating. The younger lambs will soon learn from them.

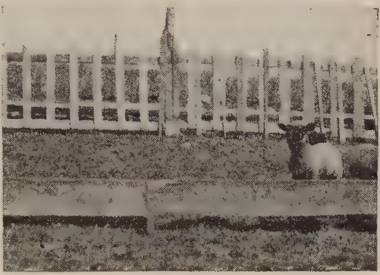

FIG. 173.—Suitable fence and feed troughs for feeding grain to lambs. The ewes are fed near the creep. The lambs have easy access to the grain during the pasture season. (Oscar L. Farris, Tenn.)

After lambs learn to eat they develop rapidly in their power to consume feed. If they are to be sent to market as fat lambs they should have all the grain they will eat, up to the time they are to be sold. If the whole crop is to be sold the grain should be high in carbohydrates as is corn, because it will make the fat desired in a prime young lamb. If part of the ewe lambs are to be retained for breeding, less carbohydrates and more protein should be given. If the grain part of the ration is largely carbonaceous, the roughage should be some legume hay of high quality such as alfalfa.

Lambs confined to the dry lot will consume one-fourth pound of grain per head daily by the time they are four or five weeks old. By the time they are seven or eight weeks they will eat three-fourths pound. They do not eat nearly so much, however, if they are on good grass for a part or all of the time. Young lambs on good grass are inclined to eat very little grain, particularly if they are receiving a good supply of milk from their dams. An important factor in feeding on grass is to have the creep located where the lambs will be inclined to visit it for play and rest. (See Job 5—Pastures).

It is important to bear in mind that sheep can thrive on many different kinds of feed provided that the same are in good condition. It is the problem of the grower to comprehend the general requirements of the breeding animals, suckling ewes, and growing lambs, and then use the feeds at hand to best advantage. Poorly balanced rations are generally uneconomical. If necessary, the grower should purchase the kind of feed needed to produce a balanced ration if that which he has will not produce it. Most important of all, it is up to a good sheepman to realize that sheep cannot produce good lambs and good wool unless they are well fed. There is an old idea, and a much mistaken one, that sheep do not require feed and care. Any animal capable of producing both a wool and lamb crop within a year needs both feed and care. No one will succeed with sheep unless he plans to give them proportionately as much feed and care as he gives any other class of live stock.

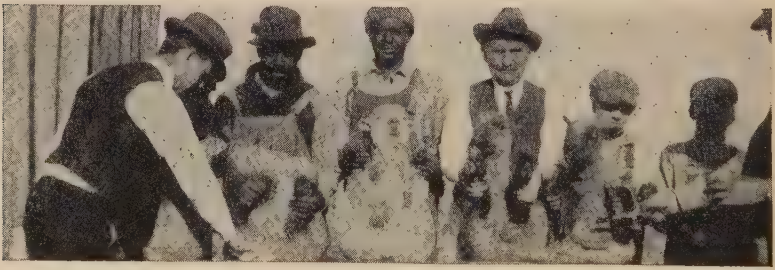

Fig. 174.—Demonstration in methods of docking and castrating lambs. Lambs are held with their rumps on a table. The operator works rapidly but uses disinfectant. (C. C. Flanery.)

Docking and Castrating.—Lambs make a better appearance and are graded higher on the market if they are docked and the males are castrated. (Figs. 174 and 175). These processes can be performed when the animals are about two weeks old. In the middle-western, southern, and eastern sections it is common practice with sheepmen to neither dock nor castrate. Farther west both are done by practically all sheepmen. The market grading seems to prove that farm flock owners would gain by docking and castrating. Apparently all these owners do not think so. Since the ram lamb castrated while very young tends to look like the female, a given crop of lambs will undoubtedly look more uniform if the males are castrated. But whether the entire or uncastrated lamb grows faster and makes better use of feed has not been generally discussed. Such evidence as is available seems undoubtedly to show that it grows faster. Again, we have not known whether leaving the lamb entire has an adverse effect on its meat. If the lamb is slaughtered before the sex instinct becomes pronounced, it probably has no effect, and perhaps not much thereafter until the animal is at least a year old, except as its condition is adversely affected by undue activity in attempting to gratify its sex desires. A twelve-months-old ram lamb would be coarser in its head, shoulders, and legs, and, therefore, coarser in general quality, than it would have been if castrated while very young.

FIG. 175.—For docking and castrating lambs use boiled water to wash parts, operate with a sharp knife, apply a disinfectant. About 50 lambs were trimmed on this Tennessee farm the day this picture was taken. There were no losses. (C. C. Flanery.)

It is really hard to say why much is gained by docking and castrating lambs if they are to be sold before they are six months old, but on the whole it seems advisable to do both. The operations are comparatively simple. It is best to castrate on a bright clear day, as there is less likely to be infection in the wounds; furthermore, the lambs should be in clean quarters at the time of the operation and for a few hours afterward. The hands of the operator and the knife he uses should be kept disinfected while the operations are in progress. A helper should hold the lamb so that it is kept still and so that the operator can get at the scrotum. The end of the scrotum is cut off and the ends of the testicles exposed. At the junction with the body the scrotum is then firmly grasped between the thumb and forefinger of the left hand and pressure applied on the abdomen. This expels the testicles so that they and the attached cords can be drawn out with the right hand. The wound should be washed with a solution of a good antiseptic and the animal released. The operation should be performed carefully but expeditiously.

As a rule docking should be performed at the same time as castrating, but for the comfort of the operator the castrating should be done first as otherwise he is likely to be spattered by the blood spurting from the wound caused by docking. There are various devices for docking, such as a sharp knife, docking pincers, a chisel, hot or cold, and an emasculator. For practical purposes a sharp butcher knife suffices. If the lambs are docked when about two weeks old they seldom bleed enough to injure them. A helper should hold the lamb by grasping its four legs and holding its back against his chest. The operator should lay the back of the blade against the buttock on the under side of the tail and with a quick stroke perform the operation. The width of the blade is a good measure of the amount of tail to leave in the docking process.

In no case should one fail to dock lambs intended for breeding purposes. Long tails on ewes interfere with the mating process, and masses of dung collect on their wool. The odor from the dung frequently attracts flies which produce maggots, and these cause an undue amount of trouble. Quite the safest practice is to dock and castrate, no matter when the lambs are to be sold.

Job 9. Controlling Diseases and Enemies

Conditions Usually Found.—(1) Many losses occur from sheep diseases and parasites. (2) They are most serious under careless management.

Aims.—The prevention of diseases and how to treat against parasites should be thoroughly understood.

Problems for Study and Discussion.—(1) Inquire to find how many local sheep men treat lambs and sheep for worms.

2. Describe the methods.
3. How do they meet the sheep-killing-dog problem?
4. How do they prevent foot diseases?
5. Give treatment for "pinning." For constipation.
6. How would you prevent and treat white scours?
7. Give directions for treatment of sore eyes, sore mouths, and "navel ill."

Activities.—(1) Under the guidance of an experienced person treat lambs for worms by drenching with copper-sulfate solution. (2) Trim the feet of sheep. (3) Treat sheep for sore eyes, sore mouth, and "navel ill." (4) Collect specimen of sheep parasites of several kinds and preserve these in formalin solution.

Parasitic Troubles.—Sheep are subject to both external and internal parasitic infestations. Carefully conducted dipping with some reliable dip shortly after shearing and again in the fall will usually keep the flock free from ticks and lice. *The scab mite* is a more serious external parasite with which to deal, and as a rule its eradication should be under the direction of a capable veterinarian.

The Stomach Worm.—Of the internal parasites the stomach worm (*Hæmonchus contortus*) causes most damage. When it and the nodule disease are both present as heavy infestations large losses are almost certain to occur. A sheep badly infested with stomach worms has a very pale skin, it loses rapidly in weight; its wool is dry and harsh; it often has an appetite for dirt, and it frequently has "scours."

Stomach worms are about one and one-half inches long. They inhabit the abomasum, or fourth stomach of the sheep, where the adult females produce thousands of microscopic eggs, which pass out with the manure and hatch outside the body. After hatching they pass through certain larval stages before being taken into the sheep's body. Warm moist weather is most favorable to the development of stomach worms and furnishes favorable conditions for the sheep to take them into its body in larval form. The larvæ have been found on moist grass stems where the sheep may get them in grazing. They are also to be found in the stagnant water at the edges of pools where sheep are accustomed to drink.

Stomach worms injure sheep by sucking blood, by destroying the red blood corpuscles, and by bacterial infection through the wounds they make in the lining of the stomach. A sheep or lamb badly infested with stomach worms may have thousands of them. If only a few are present, they cause very little apparent damage. In generally infested areas they are probably present in greater or less degree in every flock. The shepherd, therefore, needs to be constantly on his guard against them if he lives in such a community.

Prevention of heavy stomach-worm infestation is more advisable than attempted cures through drenching after heavy infestion has taken place. Permanent pastures constantly grazed by sheep, low-lying pastures, and stagnant pools are fertile sources of infestation. If the owner finds it advisable to have permanent pasture, he should use it as little as possible until after the lambs are sold. It can be used to advantage by shifting the flock to it occasionally.

It is well to drench the flock once early in summer and again just before the breeding season, as a precautionary measure, in those regions where farm flocks are kept. On the western ranges stomach worm and the nodule disease cause very little trouble.

Drenches.—The most common drenches for stomach worm are copper sulfate, nicotine sulfate, and Lugol's solution. Of the three, copper sulfate is perhaps the most favorably known. (Fig. 176.) The

U. S. Bureau of Animal Industry gives the following directions for preparing the drenching solution:

"Dissolve one-fourth pound of powdered crystals of copper sulfate (bluestone) in one pint of boiling water, using a porcelain or enamelware dish, as the bluestone corrodes most metals. Then add enough cold water to make the solution up to three gallons. This will make approximately a one per cent solution and will be enough to dose 100 adult sheep, allowing 10 per cent for waste. In the preparation of the dose use only clear, blue crystals of copper sulfate. Crush the crystals to a fine powder when ready to make up the solution."

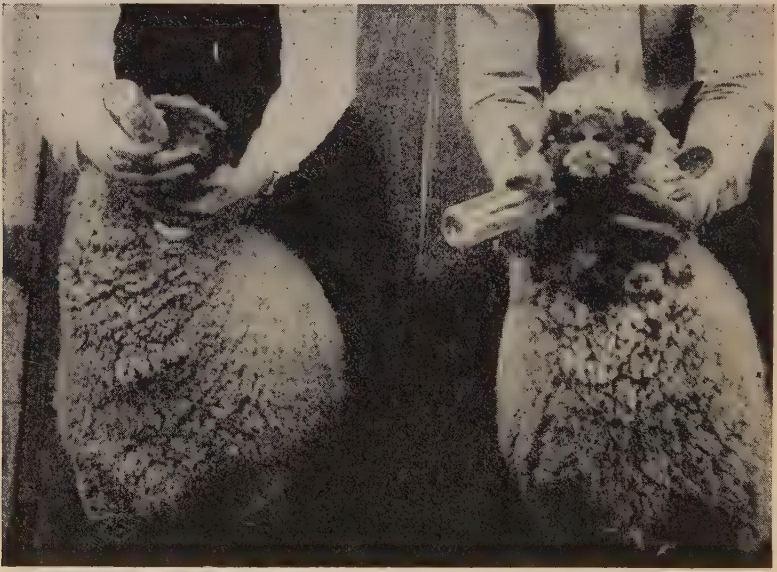

Fig. 176.—Demonstrating the methods of drenching sheep with copper sulfate solution to fight parasitic worms. Left, correct position while sheep is swallowing. Right, after the dose is given. Over 900 lambs in the region were treated after this demonstration. (C. C. Flanery.)

It is very important that the solution be of the right strength, neither stronger nor weaker than recommended, as it kills or injures the sheep if too strong and it fails to eradicate the worms if it is under-strength. The dose for adult sheep is three to four ounces; for lambs six months to one year of age, one and one-half to two ounces. (Fig. 177).

The Nodular Worm (*Æsophagostoruum columbianum*).—This parasite lives in the large intestines of the sheep. The larvæ imbed themselves in the linings of the large and small intestines and occasionally in the lymph glands of the liver, where they form knots or nodules, which when very thick interfere with the digestion and absorption of food. As is stated above, this parasite does most damage when the infestation is in conjunction with that of the stomach worm. There is no effective treatment known for it. Rotation of pastures will help to keep infestation in check.

Tape Worms.—These are serious enemies which often cause trouble in flocks. The symptoms are emaciation, pale skin, weakness, and lack of thrift, but often the sheep has a ravenous appetite. Diarrhœa and inflammation of the intestines are very common. The presence of tape worm can often be definitely determined by examining the feces of the flock, which are likely to contain yellowish-white mucus-like segments one-eighth inch long or less. These are said to be segments of the tape worm and it is claimed that they contain the eggs of the worm. When attended by heavy infestation of stomach worms, tape worms do very much harm. There is no effective remedy for them. Fortunately infestations are not as common or as persistent as those of stomach worms and nodule disease.

Lung Worms.—The thread lung worm (*Strongylus filaria*) and the hair lung worm (*Strongylus rufescens*) appear in the air passages of the lungs. They are most common in moist, warm regions. They cause irritation which frequently develops into a catarrhal condition and sometimes cause pneumonia. There is no effective cure for these worms.

In case of stomach worms, nodular worms, tape worms, and lung worms it is well to bear in mind that heavy infestations are very difficult to deal with. When it is apparent that the flock has been overtaken by a very heavy infestation of one or more of these dangerous parasites, it may be best to place the whole flock on the market and to keep no sheep for the next twelve or eighteen months, by which time the infestations will have almost or quite died out. Experienced sheepmen know very well that the best way to combat these parasites is to feed the flock well and to shift it as often as possible to new feeding grounds.

The Maggot or Screw Worm.—These names are applied to maggots of the blow fly. They are attracted to fresh cuts and to parts giving off the odor characteristic of decaying animal matter. In summer they may cause much trouble, especially in damp weather. If dung collects around the dock, or if ewes stain themselves with urine, blow flies are likely to be attracted. The eggs hatch in three or four hours and the maggots begin feeding at once. They make the sheep very uncomfortable, and if they are anywhere on its rear parts, it will turn and twist in an effort to get at the infested spot. In the case of horned rams blow flies may deposit eggs on the head near the base of the horns.

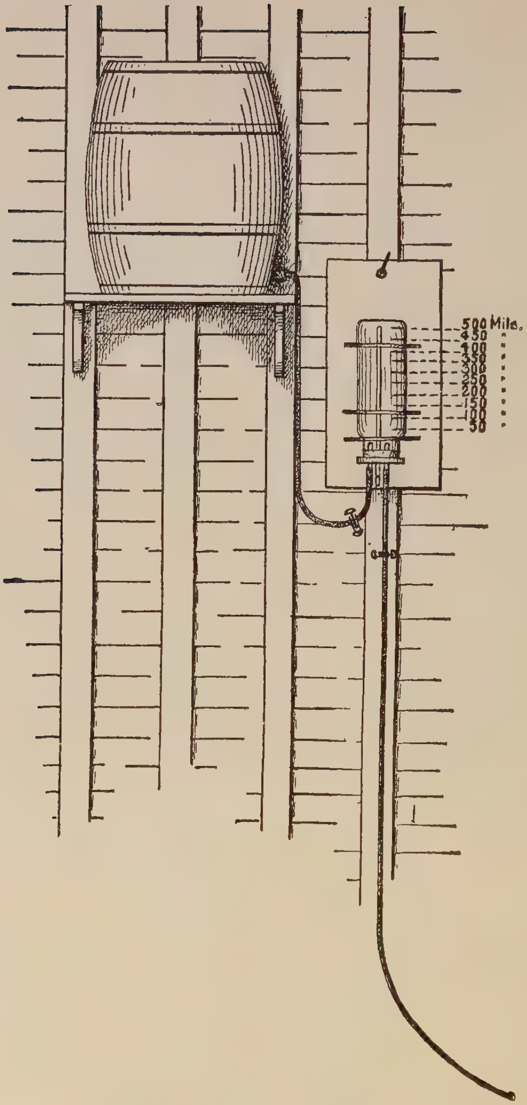

FIG. 177.—Dosing device for administering copper-sulphate solution for worms in sheep.

Maggots can be removed by an application of turpentine or chloroform. Kerosene is also fairly good for this purpose.

Sheep Grubs (*Œstrus ovis*).—This is the bot-fly which infests the nostrils and cavities of the sheep's head. They are deposited as live grubs by flies which resemble the house fly. These flies are most active in early and mid-summer and the attacks are very distressing to sheep. When the flies are about, sheep duck their heads, thrust their noses on the ground, stamp their feet, and rush from place to place to avoid attacks.

When fully developed the grubs are four-fifths inch long and one-third inch wide. They cause irritation which results first in mucus-like discharges from the nose and later in a catarrhal condition which interferes with breathing. The sheep often snort or sneeze in an effort to dislodge the grubs. There is no satisfactory cure for grubs. A liberal application of pine tar smeared over sheep's noses with a wooden paddle will help to keep the flies away. A trough having salt in the bottom with pine tar smeared on the sides will result in a fairly good application of the tar by the sheep themselves.

Foot Troubles.—Sore feet in the flock should be examined as soon as they are discovered. There is a contagious foot-rot caused by a micro-organism, *Bacillus necrophorous*, which needs to be handled at once if it is not to cause serious trouble. It can be distinguished from the non-contagious form of foot-rot by the fact that soft greenish spots containing pus develop at the upper edges of the hoofs. In treating, the hoofs should be carefully pared down with a knife, and this should be followed by applications of a strong solution of copper sulfate twice daily until the infection disappears. Affected animals should be kept away from the main flock until cured.

Non-contagious foot-rot is usually caused by the presence of some foreign substance, as a piece of wood or corn stalk, between the toes, or by a small stone or a thorn in the foot. Removing the foreign substance usually effects a cure.

The shepherd needs to give attention to the feet of his sheep even though lameness may not be present. Hoofs often grow long or unbalanced and need to be pared down and leveled in order that the members of the flock may travel about without difficulty.

Job 10. Keeping Sheep Records. Registering Stock

(See methods and forms suggested in beef and swine enterprises.)

Job 11. Improving Breeding Stock

Conditions Usually Found.—(1) Many sheep growers strive to improve their flocks by the purchase of pure-bred rams and by the selection of good females.

Aims.—Methods of improving flocks by careful selection, annual culling, and the use of good rams should be studied.

Problems for Study and Discussion.—(1) Find what farmers have bought improved stock in your region recently.

2. How are desirable, pure-bred rams obtained? What prices are paid?
3. Get opinions of farmers regarding the purchase of pure-bred rams.
4. Formulate rules for the annual culling of ewes.
5. How can the number of lambs dropped be increased through the selection of ewes?
6. Show the relation of good ewes to number of lambs raised.
7. At what time of year should the ewes be culled?
8. What notes should be kept on individual ewes during the year?
9. Debate the question: Buying improved ewes vs. culling of flock.

Activities.—(1) Draw a form for the tabulation of the lamb production, the mothering instincts, the milking qualities, and the transmitting qualities of ewes of a flock. (2) Fill such a record on a farm in the neighborhood. This may be mostly done at lambing time or soon after. (3) Practise marking ewes with ear tags or otherwise.

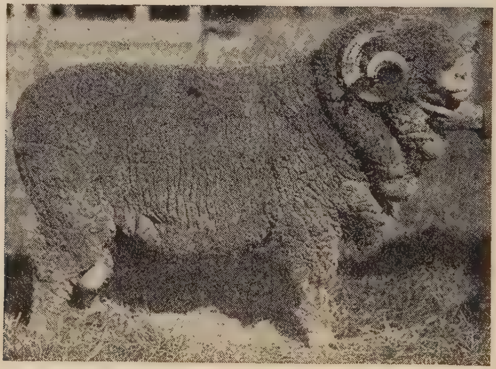

Fig. 178. Aged Rambouillet ram bred and developed by Purdue University, sold for $500 to Chase Bros., South Dakota.

Improving Mutton and Wool Qualities.—The sire is half of the flock so far as blood relationship of the offspring is concerned. A well-bred ram used with the flock is a great influence towards improving the future flock. A careful flockmaster can detect the effect of a ram upon the lambs in one year. If the effects are not up to his ideal he should change the ram for a better one.

A pure-bred ram (Fig. 178) is more certain of producing his kind than a grade ram. The difference in cost is usually greatly overbalanced by the improved returns. It is sometimes better to have one good pure-bred ram used by two or three neighbors than to have a grade ram of inferior quality on each farm. If several neighbors combine in the purchase of a ram of superior qualities the expense for each, perhaps, is less than if each owned an inferior grade.

Culling the Ewes.—A careful observer will notice great differences among ewes in the flock. Some are better mothers than others. Some are better milkers than others. Some are more prolific than others. Some produce lambs like themselves and others fail in this. Some are better breeders than others.

Each sheep owner should formulate rules regarding standards of production in his flock. Each year during the lambing season and during the milking period he should note which show the maternal instinct best and which feed their lambs best with a good milk supply; which ones produce one or two strong lambs and which ones stamp their best characteristics on their offspring.

These rules form a basis for the annual culling of the flock. This culling should take place as soon as the lambs are weaned. Ewes culled out may be placed with the flock that is to be fed for market. They should not be re-bred.

Number of Lambs.—The lamb crop is the most important product from the flock of breeding ewes. Of course the wool crop must not be overlooked. Ewes which produce two good lambs, feed them well and bring them to market condition as early as their sister ewes bring one to that stage, should always be preferred. Some ewes drop two lambs but fail to support them both. Others can hardly feed one lamb well. Careful selection with regard to number of lambs will in a few years produce a flock of ewes which will produce and raise 125 per cent or more of the number each year. Some shepherds have succeeded in producing each year twice as many lambs as there are ewes in the flock. This ideal should be kept in mind in trying to raise the standard of production year by year.

Keeping Records.—Even in a flock of grade ewes each of the members should be numbered with an ear-tag or a notching system (See swine enterprise). At breeding time keep a record of the date of breeding and note any ewes which require re-breeding later. At lambing time write down the production of each ewe and make notes regarding her motherly attitude. During the milking period record the success or failure of each ewe in raising her lamb or lambs. This record will be of great value at culling time.

Buying Better Ewes.—When culling standards are rigidly followed the number of ewes may be greatly reduced, and new members must be added to the breeding flock. This may be done either (a) by choosing the most promising ewe-lambs from the best ewes of the flock, or (b) by buying good ewes.

If ewes are to be bought they should be carefully selected from a neighbor's flock, providing records of their production have been kept. There is wide variation among individuals and careful selection must be made. (Job 2).

Job 12. Shearing and Caring for Fleeces

Conditions Usually Found.—(1) Experienced sheepmen usually shear their own flocks, or supervise it, and take care of the fleeces satisfactorily. (2) Beginners and careless herdsmen often handle fleeces carelessly and receive low prices as a result.

Aims.—(1) Students should learn best methods of shearing. (2) They should know what treatment, if any, to make before shearing. (3) They should understand best methods of handling fleeces to secure the best market prices.

Problems for Study and Discussion.—(1) Consult sheepmen regarding the best times for shearing.

2. Find their rules regarding the treatment of sheep before shearing to prevent burs, dirt and other foreign matter in the wool.
3. What instruments are used for shearing?
4. Calculate the amount of time required for shearing by different methods.
5. What management should be given the sheep after shearing?
6. What harm may result from sudden changes of weather after shearing?
7. How should the fleeces be bundled and tied?
8. How should they be kept until date of sale?

Activities.—(1) Practise shearing a number of sheep until you feel sure of your ability to do this work skilfully. (2) Practise tying the fleeces properly and sorting them by bagging. (3) Grade and bag fleeces for market or for storage.

Shearing.—Unless unfavorable conditions exist, sheep are shorn but once a year. The longer wool characteristic of twelve months' growth is more valuable than a short six months' growth.

The usual time for shearing in the middle-western and eastern parts of the United States is from the middle of April to the middle of May, after the cold weather is over and there have been a few days a little too warm for the comfort of unshorn sheep. On the whole, this is a good time to shear, as the oil has risen in the wool in sufficient quantity to make it "full of life" and facilitate the shearing. If shearing is deferred too long the wool becomes dead and lifeless. As a rule the wool from breeding ewes will be in somewhat better condition if they are shorn before they lamb, because the feverish condition frequently resulting from lambing often causes them to lose some of their wool. Moreover, the wool that is grown while they are expending so much energy in the production of milk is likely to be tender.

To a limited extent, the condition of the wool depends upon the time when the shearing is done. It is not always possible to shear at the time when the wool is in condition to suit market requirements most nearly. Oftentimes in the western part of the United States the shearing must be done either before the sheep are started from the winter range or while they are being moved from the winter feeding grounds to the spring or summer range. If this were not done the sheep would get so far away from railway lines that the cost of hauling the wool would be greatly increased. Beside this, various other factors are involved in determining the time when the shearing shall be done.

There are some objections to shearing early, one of which is that the weight of fleece is considerably less than it would be later on because there has not been enough warm weather to cause the yolk to rise in large quantity.

Shearing Equipment.—In arranging a place, every precaution should be taken to keep the wool clean. While the fleece is being removed the sheep should be placed on a smooth board platform about ten feet square; the sheep awaiting shearing should be penned where they will not drag manure and litter with them as they are brought to the shearing place.

The power machine will cut closer than the hand shears, but satisfactory work may be done with the latter if the operator is careful and possesses some skill. The amateur shearer can do much better with the power machine. In various places in the western part of the United States, thick combs should be used on the power machines to prevent the sheep from being sheared too close to the skin and thus suffering if the weather turns cold after shearing, and to prevent blistering if the weather turns very hot.

Good Shearing.—In doing good shearing it is also necessary to get the fleece without allowing it to tear apart. After setting a sheep on its rump there is a knack of holding it so that it will not kick and struggle violently. Its body should be tilted back towards the knees of the operator so that its hind legs cannot get sufficient contact with the floor to make effective resistance. Adjustment in this position aids much in holding.

It is the tendency of the unskilled shearer, whether using the machine or hand shears, to fail to cut close to the sheep's body. For example, the shearer may start to cut close to the body, but in advancing the shears he cannot follow the shape of the animal, and hence some of the wool is cut from a half to an inch away from the skin. He can, and usually does, back up and cut close where he failed in his first attempt. This makes what is known as second cuts. This greatly injures the length and selling value of the fleece.

Care of Sheared Sheep.—If the weather should be rainy or turn suddenly cold, newly-shorn sheep should be sheltered from rain and cold wind. They may be shut under sheds and fed until the weather is favorable.

When nights are cold during the spring days following the shearing, the flock should be housed by sundown. After the sheep have become used to their light coats and after the weather improves, housing becomes unnecessary.

Packing and Storing.—At the time of shearing the wool should be dry, and it should be stored in a dry, clean place if it is not taken at once to market. The fleeces of ewes, lambs, rams, and wethers should be packed separately. Or, still better, they should be packed according to grades. In small flocks it is hardly advisable to pack them in separate bags, but they can be separated in the bag by sheets of stiff, strong paper so that they can be easily sorted at the market. A bag containing a certain kind or kinds of wool should be marked so that its contents are known. Tags and wool from dead sheep should be packed separately.

The Wool Crop.—The methods to be followed in producing a good lamb crop will also result in growing a good wool crop. In selecting the individuals for the flock, attention should be given to their wool with respect to its quality, density, and extension over the body. Uniformity in fleece as well as uniformity in conformation should be sought in the ewe flock.

The market pays best prices for clean, bright wool of even strength in fiber. In order to have fairly clean wool the owner must not permit burs to grow on his farm; must provide clean resting places for the flock; must keep heavy dung tags clipped away from the docks of the sheep; must have feeding arrangements that will keep hay, straw and chaff out of the wool; and must not have sharp corners, projecting nails and wires to pull the wool out of sheep's bodies.

After the fleece is removed, heavy foreign materials such as tags from sweat and dung should be discarded, and it should be neatly tied with a smooth twine that does not cling to and shed particles in the wool. It is better to tie the fleece so that the side that grew next to the skin is exposed.

Job 13. Showing and Selling Breeding Stock

Conditions Usually Found.—(1) Owners of pure-bred sheep often show at fairs. (2) A Few of them have occasional or annual sales to dispose of surplus breeding stock.

Aims.—(1) Breeders should learn to prepare animals for show and for sales. (2) They should know how to make up sale catalogs. (3) They should know how to prepare exhibits and to conduct sales.

Problems for Study and Discussion.—(1) Study methods of sheep men who prepare stock for fairs and for sales.

2. Find how they select animals to be shown at fairs.
3. How do they select those which they are to offer for sale?
4. Study premium lists of state and county fairs and learn the classes of sheep.
5. Describe the washing of sheep to avoid injury.
6. Describe the blocking of sheep for show purposes.
7. Tell how to trim the feet and legs for showing.

8. Give directions for the handling of sheep in a showring.

Activities.—(1) Help prepare sheep for fairs or for sales, (a) wash, (b) trim feet, (c) blanket, (d) block the body. (2) Practise catching, holding, handling, and driving as these operations should be done at fairs or sales.

Showing at Fairs.—Owners of pure-bred flocks of sheep often find it advantageous to show breeding stock at fairs. This is a very hard job and often consumes much time, energy and attention. (Fig. 179).

Three results may be secured: (a) the business of the farm may be advertised very favorably and a good reputation may result; (b) premiums may be won; (c) sales may be found for animals taken to fairs for that purpose.

Preparing for Show and for Sale.—The methods used for preparing animals for show are similar to those used for preparing them for sale. Practice and experience in preparing animals for show are worth a great deal to the young sheep man. Among the important steps in this preparation are proper feeding; securing healthy animals; selecting the best individuals (Job 3); washing and otherwise cleaning the sheep; trimming and blocking the coat; trimming the feet; blanketing; handling and training for the ring.

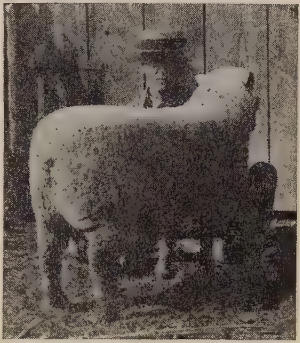

Fig. 179.—Young ram well blocked in preparation for the fair. (Devero Bros., Ky.)

Using Fair Catalogs.—Premium lists from fairs should be studied and all the terms used regarding the classes should be well understood. This is necessary before selecting the animals to be shown at a fair. Rules should be studied carefully so that no conflict with them will develop later. Decide which classes can be entered for competition with the best prospect of success.

Some fair associations allow breeders to take to the fairs animals intended for sale along with the show animals. These are penned separately and the owner can usually find prospective buyers among the visitors at the fair. If fees are charged for the use of pens, the rates may be learned from the catalog or by writing to the fair association.

Advertising.—When breeding stock are to be offered for sale the responsibility of the breeder must be clearly set forth to the public. Buyers are dependent upon his honesty, uprightness, and accuracy of record. If careful culling has been done this should be set forth. If superior animals are offered for sale their superior qualities should be clearly shown. Some public sales are made up of culls from good flocks. Buyers are often suspicious and fail to buy at auction sales. Every legitimate effort should be made to relieve buyers of all fear regarding the danger of buying inferior animals.

Job 14. Marketing Lambs, Sheep and Wool

Conditions Usually Found.—(1) Lambs are usually sold as soon as they reach suitable weights. (2) Wool is sold either to local buyers or to bidders, and prices are based on grades which are gradually becoming standardized. (3) All classes of live sheep are sold in central markets. (4) Coöperative marketing is being followed in many places.

Aims.—(1) Students should understand marketing methods minutely. (2) They should know the value and methods of coöperative marketing of wool and animals.

Problems for Study and Discussion.—(1) Ask farmers regarding prices received and dates of sale of lambs, of mutton sheep and of wool.

2. Find how many early lambs were sold from your region last season.
3. Find the grades of these and the prices which they brought the owners.
4. What classes and grades of other sheep are sold from your region?
5. Find how much wool is sheared and sold locally.
6. To what markets is the wool sent?
7. Explain the working of a wool pool.
8. What are the advantages of such a pool?
9. Describe how wool is prepared for sale in your region.
10. How many rams and breeding ewes were sold locally last year?
11. Compare prices received for these with those received for fat sheep and for feeders.

Activities.—(1) Write up a contract and set of rules for a local wool pool. (2) Tabulate the prices of wool of the grades produced in your region for the first of each month through the season or for a year. (3) Graph these prices to show at which month the price is highest. (4) If possible let your study cover several years and see if the peak price comes at about the same season each year.

Selling Early Lambs.—The demand for early lambs in larger markets is always good and prices are usually encouraging. (Fig. 180) The weights required are usually 75 to 85 pounds. Allowance must be made by the shipper for some shrinkage in weight. Carload lots may be easily made up either by local buyers or by farmers coöperating with each other. The lambs should be weighed or closely judged so as to be loaded uniformly and have none in the car which do not meet market requirements. Docked lambs are always preferred, and males should be castrated when two weeks old.

Standardized spring lambs are of good market type and conformation. They are docked, males are castrated, and the weight at the delivery point is 75 pounds or nearly that. They should have a dressing percentage of 50 per cent or over. To attain this condition, they should be fed grain as early as they will eat it.

Marketing Other Sheep.—The fat sheep are graded according to age, sex, quality, weight, and condition. The younger sheep of comparatively light weight usually bring best prices.

Central markets often receive many thrifty sheep not finished for the block. Many of these are called "feeders" and are resold to other farmers to be finished for market at a later date. Sheep suitable for breeding are also shipped to central markets. The number coming from farm flocks is small, but sometimes large numbers of high-grade animals are shipped from western ranges to be sold to farmers in the middle-western states for breeding purposes. Farmers producing pure-breds often sell individuals or small numbers to others as foundation stock for their flocks. These may be sold at auction, at fairs, or at home sales.

Marketing Wool.—The claim is made that there is no open market for wool in the United States. For this reason it is difficult for the grower to know what his wool is worth. An open market would be a great help to the grower, but without a knowledge of about how much his wool will shrink in scouring, he would still be more or less in the dark. Owners of small clips are, as a rule, at great disadvantage in selling, for they cannot get in touch with agencies whose chief business consists in handling wool. With the development of more interest in farm flocks, conditions for selling small clips will undoubtedly improve.

Fig. 180.—Lambs ready for market. The early spring lamb industry is of growing importance in several southern States. Six points in producing standard spring lambs for market are docking, castrating, drenching, feeding grain, breeding early, and using the best rams. These lambs failed only on the last point. (Oscar L. Farris, Tenn.)

It is best to store and market wool in bags, as it is the more likely to be kept clean. The bags should be closely woven, so that they will effectively keep out dust and dirt. They should also be of a type that will not shed particles of fiber into the wool. The loosely woven jute bags commonly used are satisfactory in neither particular.

Coöperative Selling.—Wool is often pooled by counties, regions, states, etc. Farmers desiring to sell their product agree to let a selling association handle the product and return the net results of the sales. These advantages are gained: (a) Buyers are glad to have a large supply of wool offered in one lot. (b) More buyers are attracted and more bids for the product are offered. (c) More careful and uniform grading is obtained if an expert grader is employed. (d) Bags and twine are purchased in larger lots and are more suitable for packing wool. (e) Money is saved on freight and handling. (f) Market quotations are more closely watched and favorable selling times secured.

Wool pools almost invariably yield better net returns for growers than are obtained from individual selling.

Early lambs and other sheep are often marketed coöperatively with several of the above advantages.

Market Classes and Subclasses of Sheep

Classes	Subclasses
Mutton sheep (native and western sheep)	Lambs Yearlings Wethers Ewes Bucks
Feeder sheep (western sheep)	Lambs Yearlings Wethers Ewes
Breeding sheep (native and western sheep)	Ewes Bucks

The three main classes are determined by the use to which the sheep are put. The mutton class includes all sheep sold for slaughter; the feeder class, all sheep sold for the purpose of being sent to farms and feeding establishments to be fattened; and the breeding class, all sheep sent out to be used as breeding stock.

Either the age or sex, or both, determine the subclass to which the animal belongs. Lambs include all sheep under twelve or fourteen months of age except those that are so forward in their development of body as to resemble mature sheep. If any of the temporary teeth have been replaced by permanent teeth the animal is not classed as a lamb. Lambs constitute about 75 per cent of the sheep sold as mutton. They are preferred to older sheep because their meat is tender and free from strong flavor, and they yield cuts of convenient size.

Market Grades.—Each different subclass, bucks excepted, is divided into from three to five grades, the full list being prime, choice, good, medium, and common or culls. The grade to which a sheep in any of the subclasses of mutton sheep belongs is determined by its form, quality, condition, and weight. Of these factors, quality and condition are the most important; but no animal markedly deficient in any of the factors mentioned can grade as prime.

Primes.—It is understood that when lambs are graded as prime they are the very best of the class that may generally be expected on the market. Prime lambs are taken largely for fancy city market, hotel, and high-class restaurant trade. Such lambs are practically above criticism in quality, condition, and weight. They are usually secured by sorting the best out of a band. This is especially true of native lambs, where the offerings in one shipment are likely to be very uneven.

Before a lamb is graded as prime it is determined by sight and touch that it possesses the form, quality, condition, and weight demanded by the dealer in high-class mutton.

Commons.—Animals in the common or cull grades are nearly always very deficient in condition, lacking good covering over the back and ribs. Coarseness and overweight, as frequently occurs with ram lambs, may cause them to be graded as common lambs or culls. Wethers in medium to good condition, but having heavy pelts and coarse features, may be graded as common. Advanced pregnancy in ewes, as well as lack in condition or quality, may contribute toward placing them in the common grade.

The Intermediate Grades.—Choice, good, and medium, indicate various degrees of deficiency below prime in condition, quality, form and weight. Animals markedly deficient in any condition or quality rarely grade higher than medium, but bad form, unless accompanied by paunchiness, is not so much discriminated against. Weight has a variable influence in determining the grade. When the supply of a certain class of sheep is not great enough to satisfy the demand it does not have much influence, but if there is a plentiful supply its influence is easily noticeable.

Prime Weights.—The desirable weights for the prime grades in the various subclasses of mutton sheep are lambs, 55 to 85 pounds, according to the time of year; yearlings, 70 to 90 pounds; wethers, 95 to 110 pounds, also 140 pounds; and ewes, 90 to 140 pounds.

Job 15. Butchering Lambs and Sheep

Conditions Usually Found.—(1) In a few neighborhoods butchering of lambs and sheep is commonly practised, particularly in cold weather. (2) In many regions no home butchering is done.

Aims.—(1) Young farmers should learn how to butcher lambs and sheep. (2) They should learn the advantages and operations of a "meat ring."

Problems for Study and Discussion.—(1) How should sheep and lambs be chosen for slaughter?

2. Describe good methods of killing.
3. Describe the dressing of the carcass for home consumption.

4. What are the differences when carcasses are to be shipped?
5. Learn the wholesale and retail cuts of lamb so you can draw them on the blackboard.
6. Compare local prices of these cuts.
7. What percentage of the carcass is waste?

Activities.—(1) Assist a butcher or an experienced farmer in slaughtering one or more sheep, including the cutting up of the meat. (2) After a little practice with others, slaughtering and cutting should be done alone.

Butchering Sheep on Farm.—Farmers may easily learn to kill and dress sheep for mutton. This product supplies meat for the home and much of it may be sold to local buyers or to dealers in nearby markets. The size of a sheep carcass gives it a great advantage over a beef carcass. Prices for mature sheep may be greater when sold in this way than when shipped alive to central markets. The pelts are easily cured, and may be used in many ways or sold separately. Neither the process of slaughtering nor that of cutting the carcass is any more difficult than killing a hog and cutting and curing the meat, a task which is ordinarily considered very simple.

Care Before Slaughter.—The animal to be slaughtered should be in healthy and in as nearly normal condition as possible at the time of slaughter. It should be handled carefully to prevent bruises on the carcass; all undue excitement should be avoided, and if possible it should be fasted from eighteen to twenty-four hours, but allowed free access to water. Attention to these details facilitates thorough bleeding, insures more rapid cooling of the carcass, lessens the danger of cutting the internal organs, and tends to prevent the disagreeable flavor of the meat caused by the fermentation of feed material in the stomach. The fleece should be dry and reasonably clean, as it is practically impossible to hang up a clean carcass if the fleece is wet or dirty. Shearing is often advisable, since the pelt is easier to handle and remove with the wool out of the way, and the wool alone can usually be sold for as much or more than the unsheared pelt.

Equipment for Slaughtering.—A clean, dry place to work is the first essential. A low bench or box upon which to lay the animal, a sticking knife, and some provision for hanging the carcass is all the equipment required for slaughtering a sheep.

Method of Sticking.—The sheep is laid on a low box or bench on its left side with the head extending over the edge. It is held in this position by standing behind the sheep and placing the right knee in the fore flank. The lower jaw is grasped with the left hand and the knife is stuck into the neck just back of the angle of the jaw slightly below and behind the ear. The knife should go through the neck at one thrust, with the edge of the knife toward the head. If desired, the beginner may then turn the knife and cut out through the neck, thus severing all the blood-vessels. To stun the sheep after sticking, the neck is broken either by placing one hand on the forehead and pulling up on the jaw, or by severing the spinal cord at the atlas joint with the knife.

Removing the Pelt.—The removal of the pelt is begun at the front legs by cutting out a narrow strip down the front of the leg from the neck to the ankle joint, holding the foot, in the meantime, between the knees. The legs, the point of the brisket, and the under side of the neck are then skinned. Following this the flesh of the neck is cut through in order to loosen the windpipe and gullet. In lambs and yearlings the feet are removed at the "break joint" by cutting across enlargement on cannon just above the ankle and twisting the foot. In mature sheep, this joint will not break, and the feet are removed at the ankle-joint.

The removal of the pelt at the hind legs is begun by cutting out a strip of skin down the back of the leg from the anus to the lowest point where the feet are removed. The feet should never be removed at the ankle-joint, because the tendons will pull out when the carcass is hung. The hind legs should not be skinned to as great extent as the front legs; the pelt should be merely loosened along the sides and back of the leg. The leg of mutton is a valuable cut, and by leaving the pelt on as long as possible, it is much easier to keep it clean.

Beginning at the brisket and cod, or udder, the pelt is loosened over the belly by forcing the fist between the skin and flesh. Likewise the pelt over the sides is fisted off, care being taken not to tear the thin muscles at the flanks. This is most easily avoided by fisting first down over the center of the side, and then working each way from this point over the flank muscles.

The tendons in the hind leg are loosened between the hock and the ankle by cutting between them and the bone. The legs are then tied with a cord and the carcass is hung at a convenient height. The pelt is further removed by splitting it down the center and fisting it off over the sides, flanks, and legs, and working up over the hind flank and leg, and down over the shoulder. Next the hide is loosened around the tail with the knife and the pelt is pulled down the back to the neck, where it is removed with the head at the atlas joint.

Care of Carcass.—The mutton or lamb carcass should be allowed to hang until it is thoroughly cooled, at approximately 40 degrees F., if possible. After it is cooled throughout it may, in the winter months, be allowed to freeze and can be preserved almost indefinitely if a frozen condition is maintained. Alternate freezing and thawing is detrimental to the quality and flavor of the meat. If carefully protected from flies by some such means as wrapping a piece of cheesecloth loosely about it, the carcass may be cooled in the cellar in the spring and summer months.

Method of Cutting Carcass.—The sheep carcass is very easily divided into the various cuts for table use, since each main division yields a cut of suitable size for the average family.

The additional equipment required for cutting is a sharp butcher knife, a meat saw, a cleaver, and if possible, a solid bench or block upon which to work.

For home use, the carcass should be divided into halves. With the carcass hanging, the aitch bone is cut through with a knife. The hind legs are spread apart and the carcass sawed down the center of the backbone. Each half of the carcass may then be further divided into the following cuts: breast, leg, loin, rib, and shoulder.

Slaughtering Lambs for Special Markets.—Prime young lambs weighing from fifty to sixty pounds, that are ready for sale from one to three months before the regular crop of lambs is large enough for market, are often slaughtered on the farm, and sold direct to clubs and high-class hotels in the larger cities.

They are marketed with the pelt on and are ordinarily wrapped in two separate covers for shipment, the inner consisting of tough paper or muslin, and the outer of burlap or sacking. This keeps the carcass clean, prevents excessive drying out, and furnishes some protection against bruises.

POULTRY ENTERPRISE

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Analysis into Jobs.—The jobs in the following list include the main units in a poultry enterprise. The numbers refer to U. S. Farmers' Bulletins.

1. Determining possibilities in the poultry enterprise. 287, 528, 1524.
2. Choosing the type, variety and breed to use. 684, 697, 767, 1040, 1251, 1373, 1391, 1409, 1506, 1507.
3. Culling the laying flock. 849, 1112, 1508, 1524.
4. Feeding the laying flock. 287, 528, 849, 1067, 1508.
5. Housing the laying flock. 287, 682, 1113, 1413, 1508, 1524.
6. Breeding for higher production. 682, 1508.
7. Securing the baby chicks. 1363, 1508, 1524.
8. Brooding chicks and management of the young stock. 1363, 1376, 1508, 1524.
9. Controlling diseases and parasites. 801, 1070, 1200, 1337.
10. Keeping poultry records. 511, 572, 782, 1182, 1427.
11. Preparing and exhibiting poultry.
12. Marketing poultry products. 1377, 1378, 1524.

Job 1. Determining Possibilities in the Poultry Enterprise

Conditions Usually Found.—(1) Ninety per cent of all farms have poultry, and there are larger numbers of backyard flocks. (2) Poultry raising is usually a side line but is often a specialized enterprise. (3) Chickens comprise over 96 per cent of all poultry. (4) The returns from poultry compare very favorably with other lines of farming.

Aims.—Students should learn how to determine (1) the nature of the opportunities offered in the poultry business; (2) the size of flock; (3) the type of enterprise; and (4) the requirements necessary for success in the business.

Problems for Study and Discussion.—(1) What are some of the most recent achievements in the science of poultry raising? What has made these achievements possible? Ask older farmers what changes they have seen in this.

2. What are some of the most significant problems which confront poultry keepers at the present time? Why are many of these problems different from those confronting poultry keepers ten years ago?
3. Ask farmers what they think is the present outlook for the poultry business. Is there danger of over-production in the near future?
4. How does your state compare with other states in its opportunity for producing poultry products? How does your community compare with other parts of your state?
5. What reasons can you give for the present distribution of the different types of poultry enterprises in the United States?

6. Why do the north-central states lead in total production? How can you account for the specialized poultry sections?
7. What determines the most profitable size for a poultry enterprise? How does size of business affect the economic returns?
8. What is the best way for a person to get started in the poultry business? How much capital is needed? What equipment is needed?
9. What is the nature of the labor requirements for the poultry business? How do these requirements fit in with the labor requirements of other farm enterprises?
10. What personal qualifications are essential for success?
11. What returns may reasonably be expected from commercial poultry flocks? From farm flocks? How do these compare with those from other farm enterprises?

Activities.—(1) Each student should make a farm-flock survey of the poultry practices followed in his community, including his home and several neighbors. This information should be tabulated and charted for use throughout the poultry course. Secure the following information: size of farm; number of hens in the laying flock; breed kept; estimated number of eggs per hen the previous year; number of chicks reared the previous summer; how chicks are hatched; how brooded; how laying flock is fed; what feeds are purchased; kinds of poultry buildings; diseases encountered; where eggs are marketed.

2. Make a list of the following which are located in your community: (a) commercial flocks of three hundred hens or over; (b) hatcheries selling day-old chicks; and (c) commercial fattening stations.

3. Secure an outline map of the United States and record the following data on this map: (a) Number in order of importance the six states which lead in total value of chickens and eggs produced. (U. S. Yearbook). (b) Outline the leading poultry sections of the United States (Fig. 181). (c) Locate the five leading egg markets in the United States. (U. S. Yearbook).

Recent Achievements in Poultry Keeping.—The achievements in the science of poultry-keeping during recent years have been remarkable. The following examples will illustrate:

1. **The Development of High Egg-Laying Strains.**—The hen in her wild environment usually laid from 12 to 18 eggs a year. At this rate it would require a flock of 75 hens to supply the average-sized family.

To-day we have flocks averaging from 140 to 180 eggs per hen in a year. Less than two such hens would be needed to furnish sufficient eggs for an adult, and a flock of 8 to supply a family.

Recent experiments have shown that the capacity for high egg production is inherited. By trap-nesting flocks and using for breeding stock only 200-egg hens and males from 200-egg hens, poultry breeders have been able to produce laying flocks averaging 140, 160, and even as high as 180 eggs per hen. It is quite common to find individual hens producing between 250 and 300 eggs and breeding flocks averaging 200 eggs per hen. This is a remarkable achievement in the science of poultry breeding.

2. **The production of winter eggs** is another achievement of economic importance to the poultryman. Spring is the natural period

of reproduction for fowls and all normal hens will lay some eggs at this time, regardless of the kind of feeding and care they receive.

Data collected by the United States Department of Agriculture show that more than half of our total egg production comes in the spring and early summer months, when fresh-egg prices are lowest. The remaining one-third of the production comes at a time when prices are highest.

Recently poultrymen have found that by regulating the amount of animal protein in the ration and by increasing the length of the working day by means of artificial illumination they can make hens produce eggs during the winter. It is not uncommon at present to find pullets under skilful management laying from one-fourth to one-third of their total production during the early winter months. This very materially affects the returns from the poultry business.

3. **The discovery of the effects of vitamins and sunlight** on the health of growing chicks and laying hens. For several years poultry specialists have stressed the importance of animal protein in the ration. Recent experiments have shown the importance of the vitamin content and the mineral content of feeds. Leg weakness in chicks and soft-shelled eggs in hens, both of which have caused large losses in the past, have been found to be due to the lack of the proper assimilation of calcium and phosphorus in the chicken's body. Experiments have shown that by supplying Vitamin D in the ration or by exposing the chickens to direct sunlight or an ultra-violet lamp these nutritional troubles can be avoided or remedied.

What has made these Achievements Possible? Twenty-five years ago poultry keeping could scarcely be called a science because very little experimental work had been done. Since that time hundreds of experiments have been conducted. When studying such a new and growing science, students should not be surprised to find disagreements and conflicting recommendations in current poultry literature. This is inevitable when experimental work is being carried on independently at so many different places. This state of affairs is frequently bewildering to the practical poultryman and sometimes makes him skeptical of experimental work, but to the student it should be a sign of progress.

Some Problems Confronting the Poultry-Keeper.—Any person who assumes the responsibility for managing a poultry business, whether large or small, is constantly face to face with problems. Every problem calls for decisions which must be made.

Suppose, for example, that a farmer decides that he needs 200 pullets to add to his laying flock next fall. Why did he decide upon 200 rather than 100 or 500? Was it because this number would allow him to make the most economical use of his poultry houses and equipment? Or was it because in connection with the labor requirements of his other farm enterprises, this would give him the best labor distribution throughout the year? We may say that his decision was good in the degree that he considered all the factors which affect his returns from the business. Suppose the farmer next decides to raise these pullets. Again he must decide whether to raise the chicks himself or to buy day-old chicks.

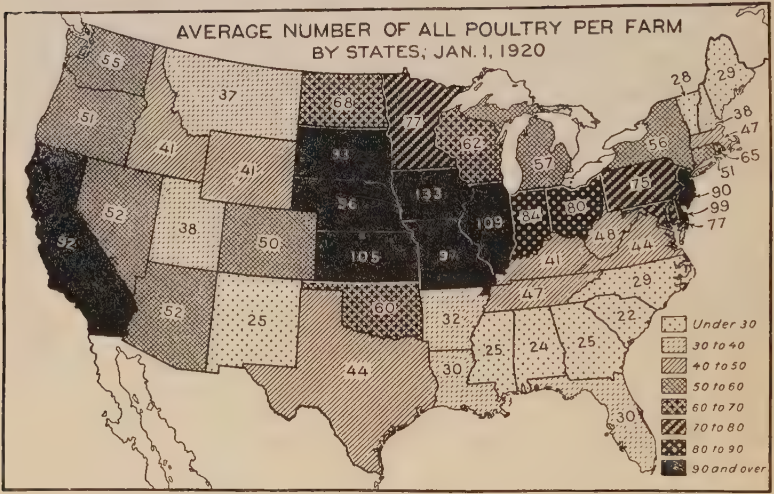


FIG. 181.—Distribution of poultry in the United States. These figures are based on all farms in each state. Of the farms in the United States, 90.8 per cent keep poultry. The average number of poultry per farm varies from 22 in South Carolina to 133 in Iowa. (U. S. Dept. of Agr.)

And so we find that in managing a poultry business the farmer must make one decision after another. Good poultry management requires that a person become skilful in analyzing problems and in making decisions.

Formulate a detailed list of the decisions which a poultryman is called upon to make. The following examples will illustrate:

1. Deciding on the type and breed of poultry to keep.
2. Determining the number of laying hens to keep.
3. Deciding whether or not to equip the poultry house with lights.
4. Deciding whether to raise the chicks or buy day-old chicks.
5. Deciding on the source of animal protein.

Distribution of Poultry in the United States.—Whether a person is planning to enter the poultry business for the first time or to make adjustments in the business he already has, he should know something of its size, distribution, and past history in order to determine as far as possible its probable future.

Poultry is widely distributed throughout the United States. The graphic map (Fig. 181) shows this distribution. The table gives this distribution by sections.

Production of Eggs in the Different Sections of the United States.
(U. S. Census)

Section	Per cent of total production	Per cent of total population	Per cent of land area in farms
New England and Middle Atlantic States....	12.5	30	6.0
North Central States......................	51.5	32	39.5
Pacific Coast States......................	6.0	5	6.0
All other states..........................	30.0	33	48.5

The North Central states lead in production for the following reasons:

1. This is the leading grain section of the country. Corn and small grains form the bulk of the poultry feeds and the bulk of them is raised in this section.

Fig. 182.—A profitable farm flock of Leghorn pullets. This flock is the home project of a student in vocational agriculture in the New Bremen (Ohio) high school.

2. Eggs can be transported from where they are produced to where they are needed for consumption more economically than can the feed required to produce them.

3. Diversified farming predominates in this section and poultry is handled as a sideline. Under these conditions poultry products can be produced on a narrower margin.

It should be remembered that the bulk of our poultry products are consumed on farms and in towns and small cities in the various sections where they are produced and never reach the principal markets. The surplus, however, does finally reach the larger markets, where it is largely responsible for determining the prices for which eggs must sell throughout the country.

In 1920 the country was producing about what was required to supply its needs. Since that time the production of eggs has increased approximately 35 per cent. What effect has this had on our balance of production and consumption? Two things have helped to absorb this increased production:

1. The population has increased about 10 per cent.
2. Our average per capita consumption of eggs has increased from 14.6 dozens in 1920 to over 20 dozens at present.

The Outlook for Poultry Production.—The following factors should be considered in making a study of the future of the poultry business:

1. The increase or decrease in the amount of poultry on farms.
2. Market receipts at the principal egg markets.
3. The cold-storage holdings.
4. The price of eggs as compared with the prices of other table products.
5. Industrial conditions as reflected in the workingman's ability to buy eggs.

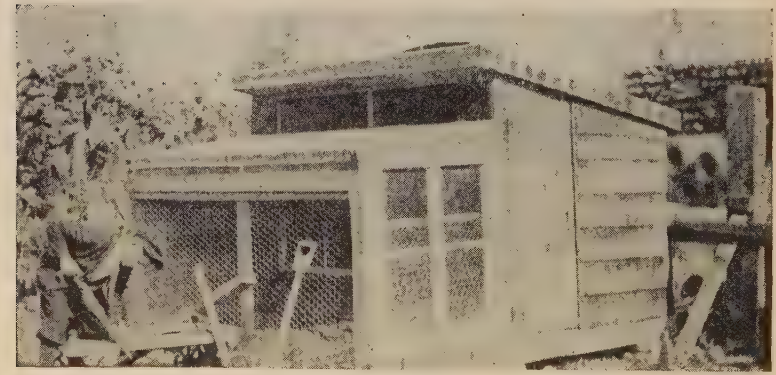


Fig. 183.—A poultry house constructed of old materials for a back yard flock. This was done by a student in vocational agriculture in the high school, Waterloo, Wisc.

Diversification of the Poultry Industry.—Poultry is kept by a greater number of families and under a greater variety of circumstances than any other farm livestock. While poultry-keeping is principally a family enterprise, the work being done by women and children, it is one of the most highly commercialized of our farm industries. While we have a few highly specialized poultry districts in New England and on the Pacific coast, the aggregate production of the family farm flocks is far in excess. The chief kinds of poultry enterprises are the farm flock, the commercial flock, the backyard flock. (Figs. 182 and 183).

The Farm Flock.—The family-size farm flocks on 90 per cent of the farms in the country produce the bulk of the poultry products. These flocks range from 50 to 300 hens. A large percentage of the products from these flocks are consumed locally by people on the farms and in nearby towns and villages. The surplus is sent to the larger markets, such as New York, Boston, Philadelphia, Chicago, and San Francisco.

The hens are usually allowed free range from early spring until late fall, which reduces the labor requirement to a minimum when the farmer is busy with his crops. Women and children usually furnish the labor during this period. During the remainder of the year, when the flock is housed and requires more labor, the farmer has more time to devote to the poultry business. Under these conditions poultry products can be produced at a minimum cost.

Commercial flocks have increased rapidly in number during the last few years. Certain sections have become noted as egg-producing sections. One of the most widely known is the Petaluma district in California. The Leghorn breed predominates and the district is noted for its high-quality table eggs. The industry is so highly specialized that these poultrymen devote all their time to the laying flocks. Large central breeding plants and hatcheries have been established to furnish these poultry farmers with chicks. The Vineland district of New Jersey and the Little Compton district in southern Rhode Island are also noted egg-producing centers. There are a few sections noted for the production of live poultry.

Poultry-keeping is well adapted to specialization because it utilizes labor fairly constantly throughout the year. Compare poultry with other farm enterprises such as potatoes, wheat, swine, and dairying with respect to their possibilities for specialization.

The Back-Yard Flock.—(Fig. 183). Many people in towns and villages keep a small flock of hens in order to have a supply of fresh eggs and meat. These flocks have increased recently because of the widespread interest in poultry and the comparatively high prices of poultry products.

The Hatchery.—Many farmers and commercial poultrymen have discontinued hatching their own chicks. They prefer to leave the problems of keeping breeding flocks and hatching chicks to the commercial hatchery. This demand for day-old chicks has caused hatcheries to spring up all over this country with capacities ranging from a few thousand to half a million eggs. Many hatcheries maintain breeding flocks of 200-egg hens from which they obtain a supply of males. These males are used in the surrounding community in farm flocks which supply eggs to the hatchery.

How to Get Started in the Business.—It is usually advisable for a person entering the poultry business to begin on a small scale and grow into the business gradually. There are four principal ways of getting started: (1) buying outright; (2) share rent; (3) partnership; and (4) working for a salary.

The beginner may start in one of several methods: (1) Buy pure-bred eggs to be hatched in a machine. (2) Buy pure-bred eggs and a few hens to hatch them. (3) Buy day-old chicks and make or buy an artificial brooder. (4) Buy a flock of pullets in the fall and a sufficient number of males of the same breed. (5) Buy a flock of hens and males to correspond. (6) Students studying agriculture often take over the home flock and manage it for a year, culling and improving it and the equipment in many ways. The time of year will often help determine the method of starting.

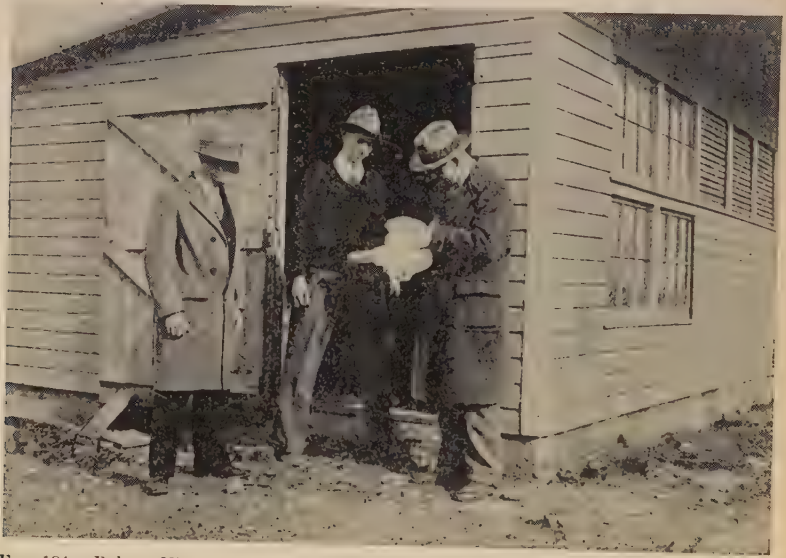


FIG. 184.—Robert King and his agricultural instructor examining pullets for lice. Notice Robert's new 20 x 30 laying house.

Both fall and spring offer seasonal opportunities for beginning the poultry business. Starting in the fall involves buying mature hens or pullets. It has been possible during the past few years to buy Leghorn pullets in August and September for from $0.75 to $1.50. A laying house and interior equipment of sufficient size to take care of the flock is also needed. This involves an additional investment of from $1.50 to $3.00 per bird. Starting in the spring involves buying or hatching chicks and raising the pullets.

Many boys and young men get started in the poultry business by electing a poultry project in Vocational Agriculture. The following examples will illustrate: (Fig. 184).

"Robert King entered the high school at Hilliard, Ohio, in the fall of 1924. He enrolled in vocational agriculture and elected for his home project work a four-year program in poultry. In the spring of 1925 he purchased 500 day-old chicks at 15 cents each, making a total cost of $75. He purchased a brooder stove for $20. He remodeled one room in an old log house in which to do the brooding. When the chicks were ten weeks of age, he selected 200 of the best pullets and sold the cockerels and cull pullets for broilers. In August be built a 20 x 30 unit-type laying house, the materials for which cost approximately $250.00. October first, he placed these pullets in the new house and began feeding for production. The house was not equipped with lights but he secured good winter production through the frequent use of wet mash. The flock averaged approximately 160 eggs per hen the first year. He culled the flock down to 100 hens which he kept the next year.

Fig. 185.—David Dunlap's chicks at ten weeks of age. A fine prospect for pullets for next year's laying flock.

"In the spring of 1926, Robert purchased 500 day-old chicks from which he has saved 200 pullets. He placed these in the new house October first. He remodeled a room in the old log house for the flock of yearling hens.

"Robert borrowed the capital necessary to carry on the business. In less than 18 months he was out of debt and had for his labor a new laying house, a brooder stove, 200 pullets, and 100 yearling hens. It is conservative to place the inventory value at $600.00. Robert started on a small scale, but as he learned through experience and training he planned to expand the business from year to year."

"David Dunlap of Madison, Ohio, started his poultry project program as a high school freshman in the spring of 1922. He raised 500 day-old chicks which he marketed as broilers at 12 weeks. The following spring he purchased

500 chicks from which he selected 250 pullets. (Fig. 185). These he placed in a new laying house in October and carried through a year's production. The next year he purchased 1500 day-old chicks from which he selected 335 pullets. He completed his four years of high school work and at that time had on hand a flock of 675 hens together with adequate laying and brooding equipment. His labor income during the four years was approximately $1500."

These are examples of what thousands of boys and young men are doing throughout the country as project programs in Vocational Agriculture.

Choosing the Enterprise.—In choosing an occupation, a person should consider the following: (1) personal characteristics necessary for success; and (2) the opportunities offered by the business. This decision should be made only after studying the requirements necessary for success in the different jobs.

Job 2. Choosing the Type, Breed and Variety of Poultry

Conditions Usually Found.—A large number of different breeds of poultry are found in most every community. Mixed flocks are very common. Commercial flocks more frequently consist of a single breed.

Aims.—Beginners should learn the factors to be considered in choosing a type and breed best adapted to their farm conditions.

Problems for Study and Discussion.—(1) How is poultry classified with respect to type, breed and variety?

2. Which breed is best adapted for farm flocks? For commercial flocks?
3. How many breeds are represented in your community? What breed or breeds predominate?
4. What percentage of the flocks are pure-bred?
5. What are the advantages of having a flock of one breed?
6. What are the advantages of a large number of farmers in a community keeping the same breed?
7. Why do few commercial poultrymen keep mixed flocks?
8. What factors should be considered in choosing a type and breed?

Activities.—(1) Make a chart showing the utility classes and breeds of chickens. (2) List on a wall chart the desirable characteristics of the best egg breed.

Classes and Breeds of Poultry Found in the United States.—*The American Standard of Perfection* recognizes 121 breeds and varieties, only a few of which are of economic importance. It divides them into classes, breeds, and varieties. The class refers to the place of origin, the breed to the size and shape, and variety to the kind of comb and the color within the breed. A detailed description of each breed is given in an illustrated book called the *Standard of Perfection.*

Utility Classification.—Like other classes of animals, chickens may be classified according to type or utility such as: egg breeds, meat breeds, general purpose breeds, and fancy breeds.

Characteristics of Egg Breeds.—The most popular egg breeds, such as the Leghorn (Fig. 190), Minorca and Ancona (Fig. 191) belong to the Mediterranean Class. Their most distinguishing characteristics are given:

1. *Small Size.*—For this reason they are not especially desirable as

Standard Classification of Chickens

Class	Breed	Native Home	Variety
I. American	Plymouth Rock (Fig. 186)	United States	Barred, white, buff, silver penciled, partridge, and Columbian.
	Wyandotte (Fig. 188)	United States	Silver, golden, white, buff, black, partridge, silver penciled, and Columbian.
	Java	United States	Black and mottled.
	Dominique	United States	Rose comb.
	Rhode Island Red (Fig. 187)	United States	Single comb, rose comb.
	Buckeye	United States	Pea-comb.
II. Asiatic	Brahma (Fig. 189)	Asia	Light and dark.
	Cochin	China	Buff, partridge, white and black.
	Langshan	China	Black and white.
III. Mediterranean	Leghorn (Fig. 190)	Italy	Single-comb brown, rose-comb brown, single-comb white, rose-comb white, single-comb buff, rose-comb buff, single-comb black, and silver.
	Minorca	Minorca Islands	Single-comb black, rose-comb black, single-comb white.
	Spanish	Spain	White-faced black.
	Blue Andalusian	Andalusia, Spain	....
	Ancona (Fig. 191)	Italy	Single-comb, rose-comb.
IV. English	Orpington	England	Single-comb buff, single-comb black, single-comb white.

Eight additional classes are listed in The *Standard of Perfection*, but they are of little economic importance.

a table fowl. They are not in as good favor with the poultry packer as the larger breeds. However, cockerels turned off as broilers when they weigh from one and one-half to two pounds find a ready market.

2. *Active, Nervous Disposition.*—They are alert and easily frightened and must be handled carefully. The flying habit is easily established if the attendant is not thoughtful and gentle.

3. *Early Maturity.*—Both sexes assume the appearance of small adults at a very early age. The male leghorn grows tail feathers and heavy comb and is fully feathered at the age of nine or ten weeks. This causes a heavy strain upon the growing chick and requires careful handling up to the age of twelve weeks. Because of this heavy strain the young fowl that feathers rapidly can be relied on to have much constitutional vigor. Pullets come to maturity and begin laying when from four to six months of age. If hatched early they usually begin to lay early in the fall and

then go into a molt in the late fall or early winter. This of course checks their egg production. Some poultrymen follow the practice of hatching early chicks for the purpose of obtaining eggs during the fall, expecting them to molt and depending upon later hatches to supply eggs during the late fall and winter.

4. *Good Foragers.*—Because of their greater activity the egg breeds are fine foragers. When given free range they will cover a large area and pick up a large amount of feed.

5. *Poor Sitters.*—All egg breeds are classed as non-sitters. The tendency toward egg production has become so great that they show very little desire to exercise their maternal instincts. Where egg breeds are kept, it is necessary to hatch chicks artificially.

6. *High Egg Production.*—Leghorns excel all other breeds in popularity for egg production. They are heavy, economical producers. They lay a white, uniform egg which is much in demand in certain markets.

Characteristics of Meat Breeds.—The meat breeds, such as the Brahma (Fig. 189), Cochin and Langshan, belong to the Asiatic Class. Their most distinguishing characteristics are enumerated:

1. *Large Size.*—In contrast with the egg breeds they are very large in size, possessing broad, deep, compact bodies. They are noted for quantity and quality of flesh.

2. *Slow and Sluggish Disposition.*

3. *Late Maturity.*—The meat breeds require a much longer period in which to mature than do the egg breeds. The young are slow in feathering and assume adult features much later than the egg breeds. It takes from six to eight months to mature pullets to laying condition.

4. *Persistent Sitters.*—The meat breeds are persistent sitters and good mothers, but they are seldom used for hatching. Because of their large size, feathered shanks, and clumsy movements, they are liable to break the eggs or crush chicks in the nest.

5. *Poor Foragers.*—Because of their large size and awkward movement the meat breeds do not roam far from the roosting quarters in search of food unless compelled to do so.

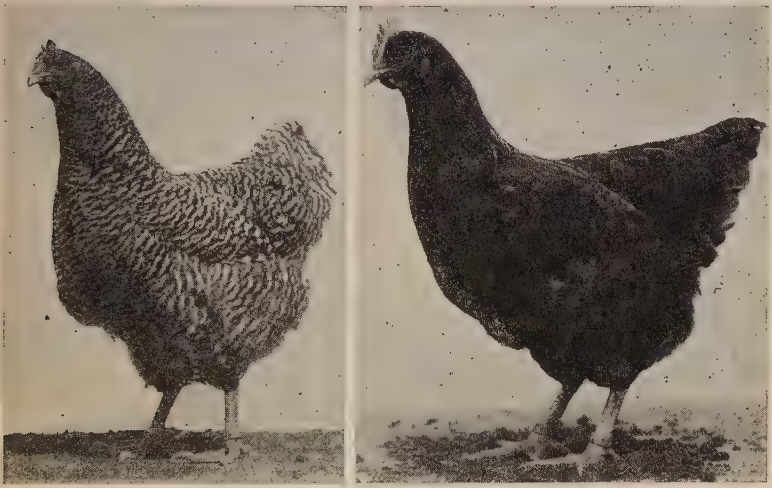
6. *Low Egg Production.*—Meat breeds are inferior to either the egg breeds or general-purpose breeds in egg production.

Characteristics of the General-Purpose Breeds.—The general-purpose breeds which have met with favor are the Plymouth Rock (Fig. 186), Rhode Island Red (Fig. 187), Wyandotte (Fig. 188), and Orpington. All belong to the American Class except the Orpington, which originated in England. They have been developed and bred for two purposes, namely, the production of both eggs and meat. Birds of this type are most commonly found on American farms, and are credited with the great mass of poultry and egg products sent to market. Farmers keeping small flocks desire a type which can furnish the home table and market with both eggs and meat.

Their most distinguishing characteristics are given:

1. *Medium Size.*—They have blocky compact bodies, being heavier than the egg breeds but not so massive as the meat breeds. The males of this class make the best market broilers. Hens which have passed their period of usefulness for egg production also find a ready market.

2. *Quiet Disposition.*—General-purpose fowls are gentle, quiet and not so easily frightened as the egg breeds.



Figs. 186 and 187.—Breeds of poultry. Plymouth Rock and Rhode Island Red, breeds belonging to the American class and the general-purpose type. (U. S. Dept. Agr.)

3. *Fairly Early in Maturity.*—These breeds do not mature quite so rapidly as the egg breeds. Pullets mature at from five to six months.

4. *Good Foragers.*—If allowed to do so they will cover considerable range in search of food.

5. *Good Sitters.*—They are splendid sitters and mothers. One objection is a large number of broody hens in the spring, which curtails the egg yield.

6. *High Egg Production.*—Recent demonstration flock records show that the general-purpose breeds equal and sometimes excel the egg breeds in total returns from both eggs and meat. They have been developed for winter egg production because of the high price at this season.

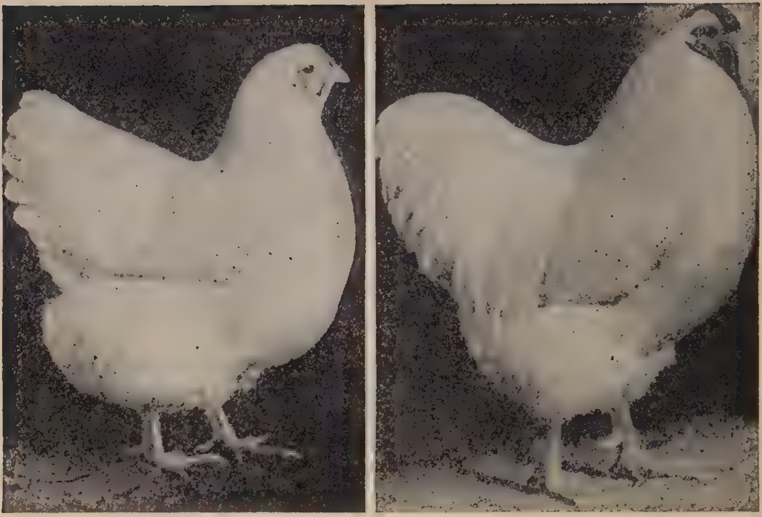


FIG. 188.—Wyandotte hen and rooster. This breed belongs to the American class and general-purpose type. (J. S. Martin, Port Dover, Ontario.)

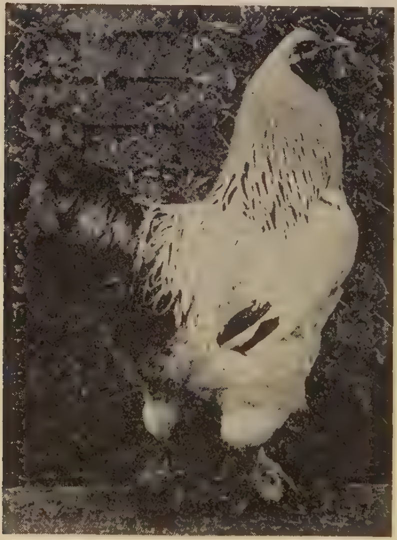


FIG. 189.—Light Brahma rooster. Asiatic class and heavy meat type. (U. S. Dept. Agr.)

Choosing a Breed to Raise.—There is no type or shape of fowl that indicates egg-laying qualities with any degree of certainty. As a result we find that no one breed has a monopoly on egg production. Various egg-laying contests show high records for individuals of all the leading breeds. Recent studies seem to indicate, however, that capacity for high egg production is more closely associated with fowls of small size and active temperament than with large size and less active temperament. This accounts for the popularity of the egg breeds on the more highly specialized farms. The choice of a type depends upon the use intended. If eggs are the most important product, then one of the egg breeds is best. If both meat and eggs are important products, one of the general-purpose breeds should be chosen. The choice of a breed or a variety is largely a matter of personal preference, market demands, or standardized community production.

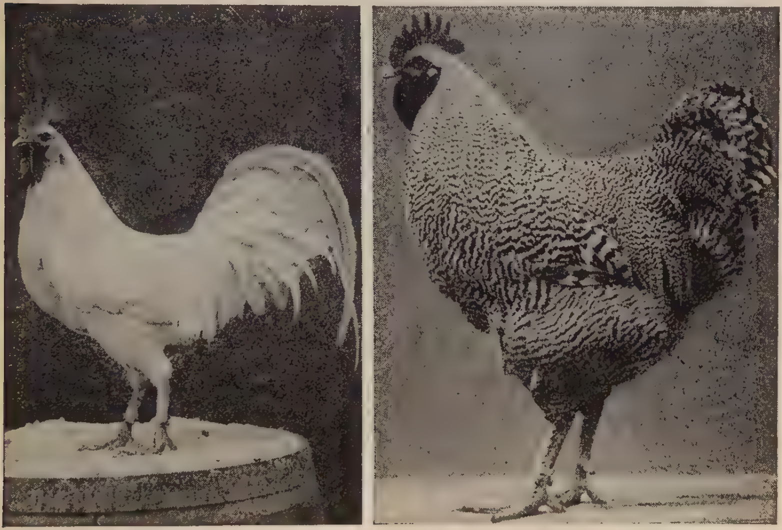


FIG. 190.—Types of poultry. Left, Leghorn rooster belongs to the Mediterranean class and egg type. Right, Plymouth Rock rooster, pullet bred, American class and general-purpose type. (U. S. Dept. of Agr.)

Job 3. Culling the Laying Flock

Conditions Usually Found.—(1) The average annual production per hen of farm flocks in the United States is 55 eggs or approximately 4.5 dozens. This number varies among the different states from 38 eggs in Georgia to 85 in Maine. The north-central states range from 50 to 60 eggs. (2) The eggs are produced chiefly in the spring and early summer. (3) The average of 460 Ohio poultry demonstration farm flocks for 1925 was approximately 140 eggs per hen. Published reports from other states show similar records. (4) A few individual hens have produced over 300 eggs in one year; a large number have produced between 250 and 300 eggs, and many breeding flocks have averaged over 200 eggs per hen.

Aims.—Students should learn how the average number of eggs produced per hen affects the economic returns from the poultry business, and should acquire skill in culling.

Problems for Study and Discussion.—(1) Why do some hens lay more eggs than others when kept under the same conditions? Make a list of the factors which may limit production.

2. How many eggs must a hen lay in order to be profitable? Inquire of poultry keepers regarding their numbers of hens and egg production. What percentage of the hens kept in your community are unprofitable?
3. Why was the trap nest an important instrument in providing a scientific basis for culling? Under what conditions should the trap nest be used?

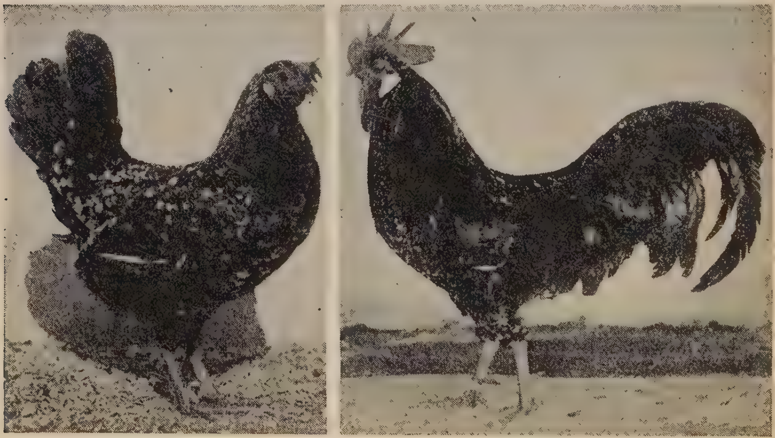


FIG. 191.—Ancona hen and rooster. Mediterranean class and egg type. (U. S. D. A.)

4. How can you determine whether or not a hen is laying at present? How long has she been laying?
5. How accurately can the yearly production of a hen be predicted?
6. What are the causes which induce non-production?
7. When is the best time of year to cull? Why?
8. How should the flock be handled in preparation for culling?
9. How does culling pullets differ from culling laying hens?
10. What percentage of culls would you expect to get from the ordinary farm flock? Upon what would this depend?

Activities.—(1) The class should cull one or more flocks and record the number of good, medium, and poor hens found in each flock. The culls should be penned for two weeks and an egg record kept of both the main flock and the culls. (2) Each student should cull his home flock and keep an egg-and-feed record for at least one year. (3) Dissect a laying hen and study the reproductive organs. The digestive organs may be studied at the same time in preparation for the job of feeding.

Importance of Persistency in Laying.—Trap-nest records show a wide variation in the numbers of eggs produced by individual hens in a year. These records frequently range from 40 to 200 eggs for hens in the same flock, which were fed the same ration and subject to the same conditions of management. Why do we find this wide variation? What limits the low-producing hen to 40 or 50 eggs a year?

Before we can answer these questions we must understand the nature of the egg-producing organs of the hen and how eggs are made. The reproductive organs of the hen consist of two main parts, the ovary and the oviduct. The yolk is the first part of the egg to develop; its development takes place in the ovary, which is located close to the backbone. The yellow egg cells may be seen hanging in the upper part of the body cavity giving the appearance of a bunch of grapes. If a normal fowl is killed while in laying condition, these yolks are found in all stages of development. All the eggs that a hen can lay in a lifetime are present in the ovary, varying in size from the mature yolk, ready to burst from its sack and start on its journey down through the oviduct, to the smallest cell visible only with the aid of a magnifying glass.

It was formerly thought that a hen's production was low because she had a small number of egg cells in the ovary. Recent counts have shown even in low producers the presence of over 2000 egg cells. Professor Dryden reports a case where through the use of a high-powered lens the enormous number of 12,476 egg cells were counted in one hen's ovary. These studies show many times more eggs in a hen's ovary than she will ever lay. Why does she not lay them?

The natural period for a hen to lay is during the spring months. More than half of our total egg production comes in April, May, June, and July. This period is too short for a hen to lay a large number of eggs. Recent investigations show that after an egg yolk has ripened in the ovary and dropped into the oviduct it requires from 18 to 30 hours for it to pass completely through the oviduct, where the albumen and shell are added. If a hen could consume and digest sufficient feed to supply the raw materials for the egg and could mature the egg yolks rapidly enough, we could expect her to lay an egg every day. High-producing hens, laying from 250 to 300 eggs, approach this condition very closely.

No large percentage of hens have the health and stamina to withstand the strain of such high production. Hens cannot be expected to lay more than from 4 to 6 eggs per week even during their highest producing period. It requires time to manufacture eggs and in order to lay a large number of eggs, a hen must be a persistent layer or must lay over a long period of time. Pullets should begin laying in October and continue through the next October. They should then be allowed to molt and rest during November and December and be ready by January 1st to begin their second season of laying.

Standards for Production.—It is essential that the poultryman have a standard or measuring device to use in checking the efficiency of his flock. The following standard is furnished to poultry demonstration flock owners by the poultry specialists at Ohio State University.

Monthly Production for 160-egg Flocks

Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
5	8	10	13	16	20	21	18	17	14	11	7

As shown in the table, if we expect the flock to average 160 eggs, we should get an average of 5 eggs per hen in November, an average of 8 eggs in December, 10 in January, 13 in February, and so on throughout the year. To attain this 160-egg goal, the flock should have averaged 36 eggs per hen by March 1st. By this standard the poultryman can check his production month by month.

How to Raise the Flock Average.—We may consider every flock of hens an egg factory. The cost of producing eggs depends upon the efficiency of each individual egg machine. The farmer, who is the factory manager, may supply the best of raw materials in the form of feed and still fail to produce enough to pay for running the plant. Good feed in sufficient quantity and variety is necessary for egg production, but ability to manufacture eggs from this feed is equally essential. How many eggs must a hen produce in order to be a profitable egg machine? It costs approximately $2.00 to feed a hen for one year. The average farm price of eggs from 1914–20 was 30 cents per dozen. At this price how many eggs must a hen produce in order to pay the feed cost?

An analysis of the record of a flock producing the United States average of 55 eggs would show the following facts: A few hens producing a small number of eggs, perhaps as low as 20 to 30; a few producing a comparatively large number, as high as 140 to 160 eggs. The remainder can be distributed on a scale between these two extremes. If possible, examine the records of a trap-nested flock to show this variation.

How can we raise the flock average? The only possible way is by cutting off the low end of the scale. We would still have a wide range of production among individuals, but the average would move up the scale. Professor Dryden cites experiments in Oregon where, in the case of Barred Plymouth Rocks, the average production moved up from 80 eggs in the first year to 180 in the sixth year. If we cull out all hens producing from 30 to 85 eggs and replace them with hens producing from 120 to 160 eggs we can soon raise the flock average. The ability to produce eggs is inherited and only high-producing hens should be used for breeding stock. Our problem then is to identify the low-producing hens.

Trap Nesting the Most Accurate Method.—The only method of getting an accurate record of each hen in the flock is the use of trap nests.

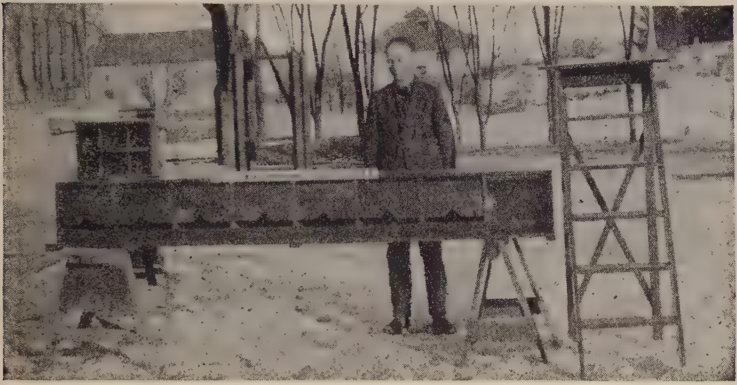
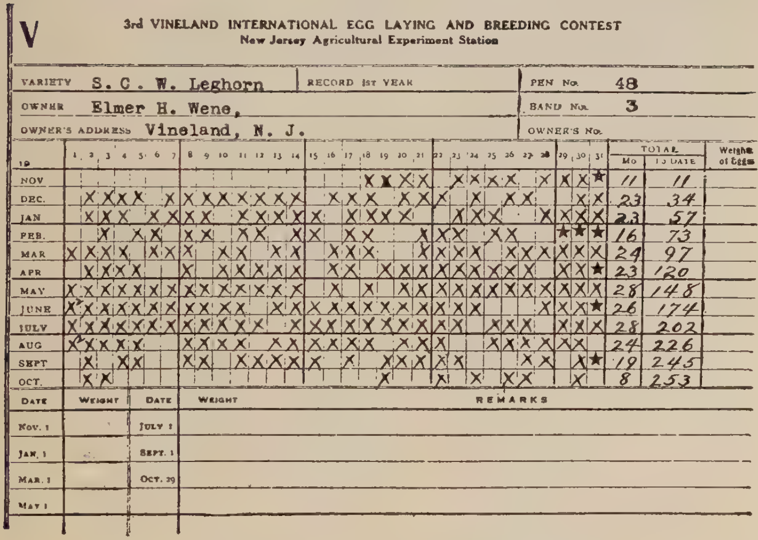


Fig. 192.—Trap nests built by a boy in Farm Mechanics at the Waterloo (Wisconsin) High School. These nests were used in his poultry project. (N. O. Eckley.)



V

3rd VINELAND INTERNATIONAL EGG LAYING AND BREEDING CONTEST
New Jersey Agricultural Experiment Station

VARIETY S. C. W. Leghorn
RECORD 1st YEAR
PEN No. 48
OWNER Elmer H. Wene,
BAND No. 3
OWNER'S ADDRESS Vineland, N. J.
OWNER'S No.

19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL		Weight of Eggs
																																Mo	To Date	
NOV																		X	X	X	X		X	X	X	X		X	X	X	★	11	11	
DEC.		X	X	X	X		X	X	X	X	X	X	X	X		X	X	X		X	X	X		X		X	X			X	X	23	34	
JAN		X	X	X		X	X	X	X		X	X	X	X	X		X	X	X	X			X	X	X			X	X	X	X	23	57	
FEB.			X		X	X		X	X		X	X		X	X		X	X			X	X	X		X	X			★	★	★	16	73	
MAR	X	X	X	X		X	X	X		X	X		X	X		X	X	X			X	X	X	X		X	X	X	X	X	X	24	97	
APR		X	X	X	X			X		X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X		X	X	★	23	120	
MAY	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X		X	X	X	X	X	X	X	X	X	X	X	X	28	148	
JUNE	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	★	26	174	
JULY	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	28	202	
AUG	X	X	X	X	X			X	X	X	X		X	X	X	X	X	X		X	X	X			X	X	X	X	X	X		24	226	
SEPT		X		X	X			X	X		X	X	X	X	X		X		X	X	X	X	X				X	X		X	★	19	245	
OCT.		X	X																X			X		X		X	X			X		8	253	

DATE	WEIGHT	DATE	WEIGHT	REMARKS
Nov. 1		July 1		
Jan. 1		Sept. 1		
Mar. 1		Oct. 29		
May 1				

Fig. 193.—Trap-nest egg record of individual hen in egg-laying contest.

These are individual nests with doors which close automatically when a hen enters the nest (Fig. 192). Each hen is retained until released by the person in charge, who keeps a daily egg-record of each hen. At the end of the year the poultryman has a performance record of each individual in his flock (Fig. 193).

This method requires too much labor to find wide application on the farm. It is profitable only where high-producing breeding flocks are maintained. This is discussed in more detail later.

Scientific Culling System.—Through the use of the trap nest scientists have been able to work out a system of culling by studying changes in body form, molting habits, color changes, and other characteristics in their relation to egg production. By studying the performance of each individual hen and observing the physical changes which take place in a hen's body when she begins to lay, at different times during her laying period, and as she goes out of production, they were able to discover a scientific procedure in culling. Without the trap nest this would not have been possible. It is possible at present for a trained observer to determine with a high degree of accuracy whether or not a hen is laying. He can also determine approximately how long a hen has been laying or how long since she ceased laying. A few years ago some poultry specialists claimed it possible to predict within a few eggs a hen's annual production. Recent studies, however, show that this cannot be done with such a high degree of certainty.

Factors which Identify a Producer.—The most important factors are listed:

Hens—vigorous, industrious, contented.
Comb and wattles—large, soft, bright.
Vent—pale, large, soft, moist.
Pelvic bones—thin, wide, pliable.
Keel to pelvis—roomy.
Molt—late, quick.
Eyes—bright, prominent.
Shanks, beak, ears, eye-ring—bleached or faded.
Abdomen—soft, pliable.
Body—long, deep, retangular.

Condition of Comb and Wattles.—The comb is a good indicator of what is going on in the ovary. When a hen is laying or nearly ready to lay, circulation is rapid and the comb and wattles are plump, velvety to the touch, and bright red in color. When the hen is not laying they are shrunken, pale, hard, and covered with white scales. (Fig. 194).

Condition of the Vent.—When a hen is laying, the vent becomes large, pliable, and moist, because of the frequent stretching as the eggs are expelled. It is also pinkish in color. When a hen ceases laying, the vent becomes dry, puckered, and yellow in color. Compare the condition of the vent of the laying hen in figure 195 with the one which is not laying.

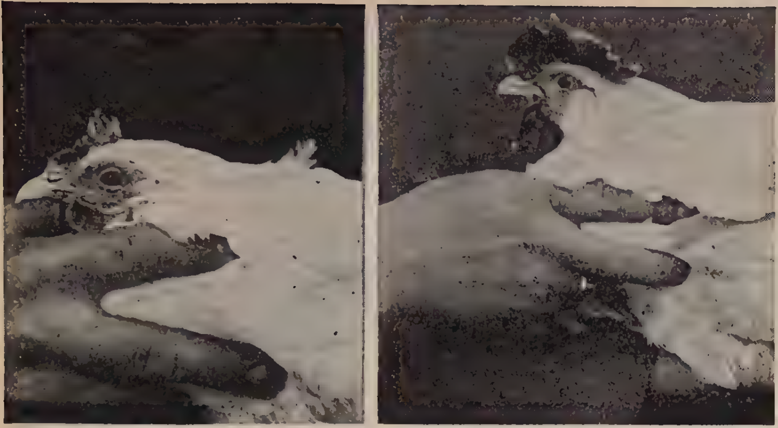


Fig. 194.—The head is an indicator of egg capacity. The hen on the left has a long, narrow head, small comb, and dull, sunken eye. The hen on the right shows much refinement and expression. Her head is short and wide on top; her beak, short, strong and curved; her eye is bright, full, and prominent; and her comb is medium large. These are good indications of egg capacity. (Ohio State University.)

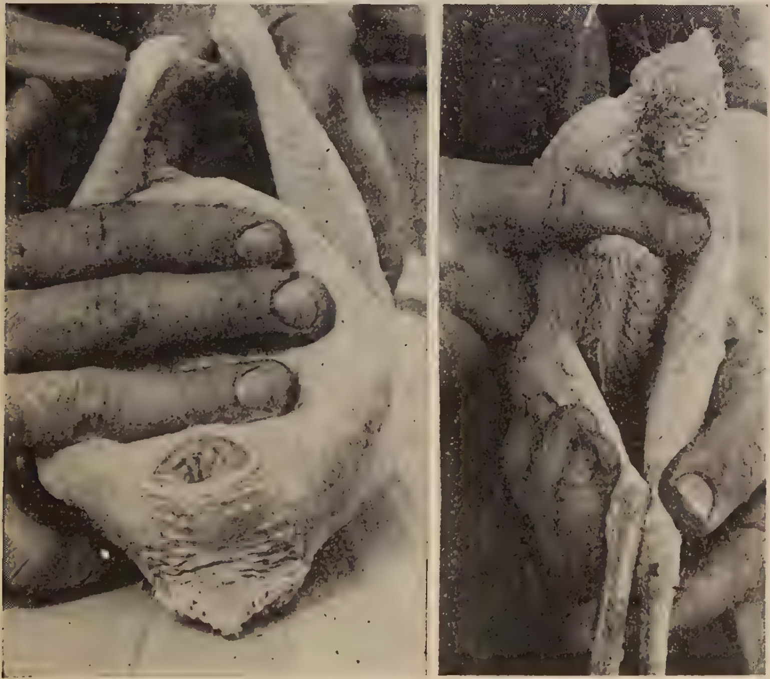


Fig. 195.—Measuring body depth on a hen with feathers removed.

The hen on the right is not laying. She measures one finger between the keel and pelvic bones. The skin is hard and leathery, and the vent is dry and puckered. The hen on the left is laying. She measures more than four fingers in depth. Her abdomen is soft and flexible; her skin thin and pliable; and her vent large and moist. (Ohio State University.)

Abdominal Measurements.—Laying hens have wide-spread pelvic bones. These bones are somewhat pointed and can be felt on each side of and slightly below the vent. They are similar to the pin bones on the cow. When a hen is laying, these bones are rather thin, flexible, and spread well apart. A common method of testing a hen for present laying is to measure the horizontal distance between the pelvic bones (Figs. 195 and 196). It should be possible to get from two to three fingers between them. The pelvic bones of a non-layer are close together. The distance between the pelvic bones indicates whether or not a hen is laying at a particular time and has no influence on the number of eggs a hen can lay.

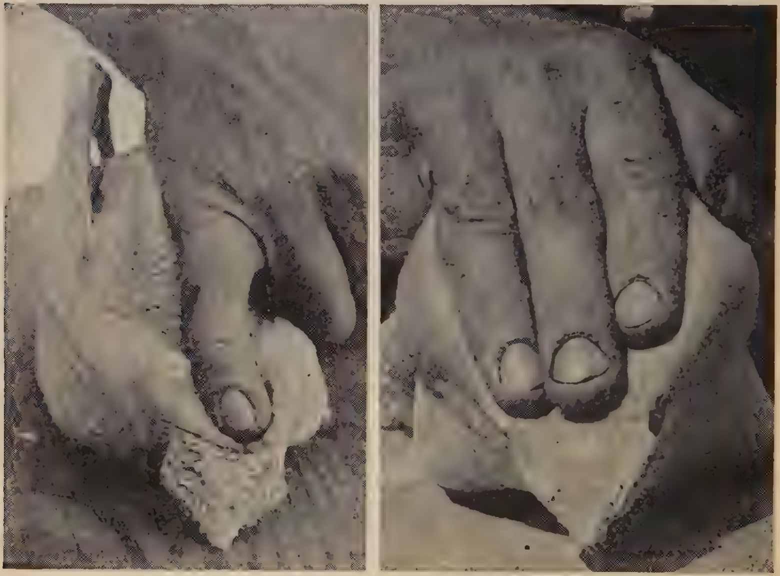


Fig. 196.—The spread between the pelvic bones as an indication of laying capacity. At the left is shown the dressed body of a non-laying hen. The pelvic bones are only the width of one finger apart. At the right is a hen that was in heavy laying when killed. Her pelvic bones are the width of three fingers apart and her abdomen is soft and flexible. Observe the difference in condition of the skins of these two birds. (Ohio State University.)

Distance between the pelvic and keel bones indicates feed capacity. When a hen is laying she eats more feed and the intestines require more room than when she is not laying. The egg-producing organs also are of greater size and require more room. They obtain this additional room by pushing down the rear of the keel and pushing out the skin of the abdomen. This distance from keel to pelvic bones varies with breed or size of bird, but the smaller breeds, such as a Leghorn that is laying, should have sufficient room for four fingers. A smaller distance or spread between these bones indicates the hen is not laying (Figs. 197 and 198).

When a hen is laying, the abdomen is flexible or soft because of the smaller amount of fat. When she is not laying, the abdomen is contracted and less pliable.

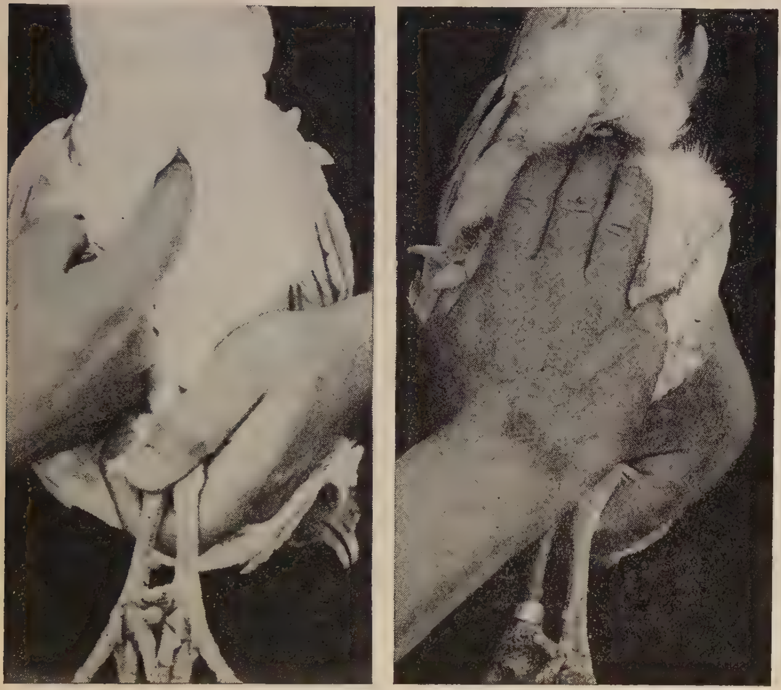


FIG. 197.—Measuring the width of the pelvic bones on a live hen. The hen on the left is not laying, as is indicated by her measurement of one finger between the pelvic bones. The hen on the right is laying heavily, and three fingers can be placed between the pelvic bones. (Ohio State University.)

Significance of the Molt.—Birds inherit the tendency to shed their plumage annually. Chickens are no exception. Some hens begin molting as early as June and continue throughout the summer and fall. Others begin as late as November and complete their molt quickly. Observations have shown a definite relationship between molting and egg production. A hen cannot grow feathers and lay eggs at the same time. She usually goes out of production because of poor physical condition and immediately begins molting. Hens that molt early require a long time to renew their feathers. Hens that molt late drop their feathers quickly and come back into production. A late molter has a longer laying period, which is necessary for high production.

1. **Early Molters.**—The early molter ceases to lay in June, July or early August. She probably began in December or January, giving her a short laying season. It usually requires 3 or 4 months to complete her molt.

2. **Medium Molters.**—These molt during August and September. Such hens should be sold unless they can be placed under light in October and November.

3. **Late Molters.**—Hens molting in October and November have had a long laying period. They molt quickly and are ready to begin laying by the first of the year.

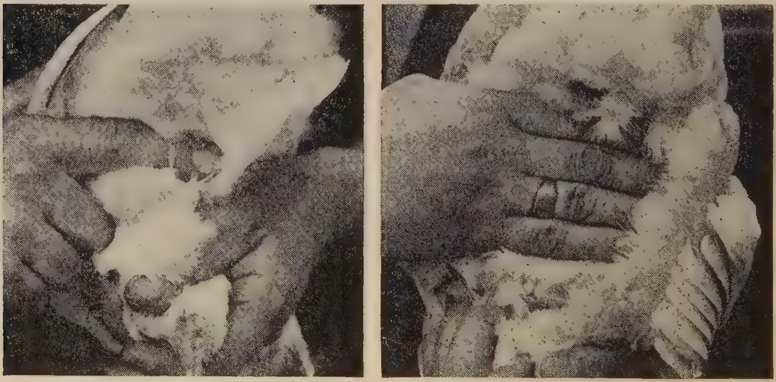


Fig. 198.—Measuring the distance between the keel and the pelvic bones on a live hen. The hen on the left is not laying. She measures only one finger in depth. The hen on the right is laying heavily, and more than four fingers can be placed between the keel and pelvic bones. (Ohio State University.)

Hens usually molt in the following order; neck, breast, body, tail, and wing.

The Wing Molt.—It is possible to determine approximately when a hen stopped laying by observing the primary feathers on the wing. Each wing usually has ten primaries (Fig. 199). The primary next to the axial is usually the first one to be dropped. Nature has provided that the wing should never be without feathers, and as a result the hen sheds them normally in regular order about two weeks apart in the case of an early molter. It requires about 6 weeks to grow a mature feather. We can allow 6 weeks for the first feather and two weeks for each additional fullgrown feather. The late molter may drop several primaries at the same time. In this case all feathers dropped at the same time should be counted as one.

Significance of Color Changes.—When a hen is not laying she stores fat in her body. The yellow color of the fat is due to a pigment called xanthophyll. This fat is found in a thin layer just beneath the skin in the shanks, beak, and all parts of the body where the blood circulates.

When a hen begins to lay, the yellow color gradually disappears as the hen uses this reserve fat in the manufacture of eggs. In the yellow-skinned breeds the fading of this color is a definite means of distinguishing laying from non-laying hens and is also an aid in distinguishing good from poor yearly layers. It is possible to estimate the approximate time required for bleaching out the various parts of the body and the time that has elapsed since the hen began to lay. The color disappears in the following order:

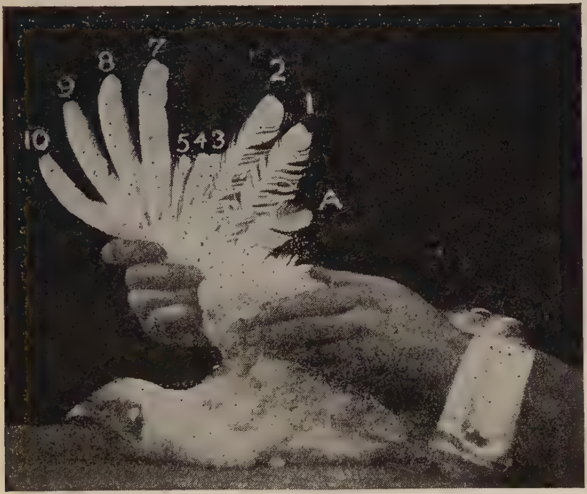


Fig. 199.—Wing showing order of molting primaries about two weeks apart. New feathers grow in about six weeks.

1. *Vent.*—The color will disappear around the edge of the vent after a few eggs are laid, because of the rapidity with which the blood circulates through this part.
2. *Eye-ring.*—Bleaches out a trifle slower than the vent.
3. *Ear lobes.*—Bleached ear lobes denote two or three weeks of laying.
4. *Beak.*—Soon after laying begins, the beak at the corner of the mouth starts to bleach. As laying continues, the color disappears until the entire beak is bleached. The lower part will bleach faster than the upper. A well bleached beak indicates six to eight weeks of heavy laying.

5. *Shanks.*—The scales in the shanks fade slowly because circulation is slow. Well bleached shanks usually indicate from five to six months of laying.

After a hen ceases to lay, the yellow color is deposited in the body slightly faster than it faded out. It reappears in the vent, eye-ring, ear lobe, beak, and shank in the order named. As the color returns in the beak it begins at the corners of the mouth and works outward toward the tip. Hens should not be culled on the basis of color alone.

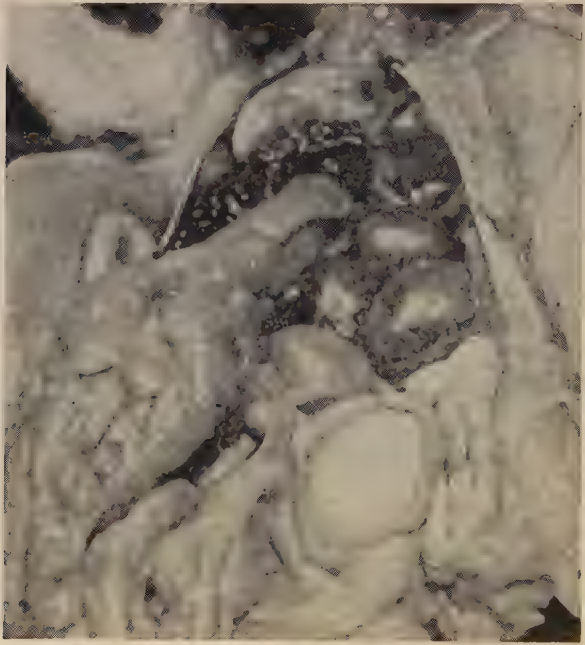


Fig. 200.—Evidence of why a hen in heavy lay must have large capacity. Four large yolks and a complete egg may be easily distinguished. (Penn. State College of Agr.)

Capacity.—Body depth is important because it indicates a hen's ability to consume large quantities of feed and allows room for the reproductive organs to function (Fig. 200). A hen with desired capacity will have a broad level back, and a long straight keel. She should be healthy and vigorous in order to withstand the strain of high egg production.

Causes Which Induce Non-Production.—Many hens lack the vigor and stamina necessary for high egg production. They weaken, grow thin, stop laying, and begin to molt. Other causes are poor management, poor ventilation, crowding on the roost, lack of green feed, and sudden change of feed.

What Hens to Sell.—1. All undersized, unhealthy, or abnormal birds that are cripples, such as those with frozen feet, weak legs, twisted beaks, and long crooked toenails.

2. Hens that molt before September 1st.
3. Persistent sitters.
4. Hens that start laying late in fall and stop laying early in the summer.
5. Hens that are narrow between the pelvic bones or between pelvic bones and keel and have a hard shrunken abdomen.
6. Hens with breed defects and disqualifications, especially if the flock is to be used for breeding purposes.

When to Cull.—Weak, undeveloped, unhealthy, or crippled hens should be thrown out whenever found. When culling the laying flock, two procedures may be followed:

1. Begin to cull July 1 and cull at frequent dates until September 1. Take a flashlight and go through the house at night and select hens with dried-up combs that show a dandruffy appearance and yellow beaks. Place them in a crate and examine them next morning, applying all the tests described. In August or September the entire flock should be systematically handled.

2. If the flock has not been culled previously and only one culling is possible, it should be done in July or August. This will catch most of the early molters.

Culling the Flock.—Any person culling a flock should become familiar with the conditions under which the flock has been kept. Accurate culling cannot be done unless the feeding and management of the flock have been such that the good birds could lay. If the hens have not been properly cared for, they should be placed under desirable conditions for at least a month before culling.

When a systematic handling of all the hens is planned, they should be penned the night before. A catching crate should be provided in order to handle the hens with the least amount of disturbance (Fig. 201). The culls should be placed in a separate pen and fattened for market.

Should Hens be Kept Beyond their Pullet Year?—All available records of high-producing hens show that they produce more eggs during their pullet year than they do the second year. The chief reason for this is that the pullet begins laying in October or November and continues to lay until the next October or November. During the second year she does not begin to lay until January first, because she must have time to rest and molt. For this reason many poultrymen are following the practice of raising pullets to replace the flock annually. The experimental results at the Maine Station showed greater returns where pullets were raised to replace the flock each year. While the data at present are limited, further study may show this to be the best practice.

Culling pullets is more uncertain than culling laying hens. No record of performance is yet stamped on the body of the pullet. The characteristics which should be observed are as follows:

1. The better prospective producers will mature rapidly. Cull out all slow-growing, undeveloped, weak, immature pullets. Save pullets with prominent, full eyes, clean-cut heads that indicate vigor, and deep bodies with broad backs. These birds also have long keel bones, stand squarely on their legs, and mature rapidly.

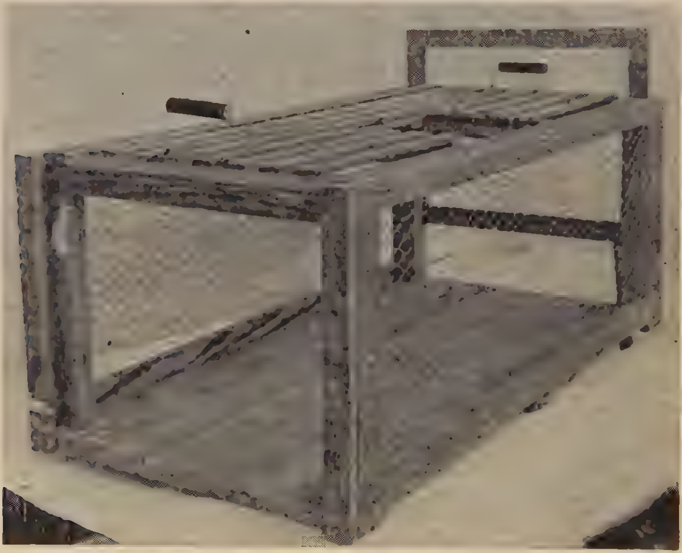


FIG. 201.—A convenient catching crate for culling. This simplifies the work of catching and handling the hens in culling. Placed outside the exit door of the poultry house, the crate is readily filled with hens. (Ohio State University.)

Trap-nest records have shown that the pullets that are well developed usually begin to lay earliest. Early maturity and heavy egg production are closely associated. A bird that matures rapidly and begins to lay young is said to be precocious. Precocity is largely influenced by rearing conditions. It is, however, a reliable index to ability to produce eggs, providing these conditions have been normal. Out of 300 White Leghorn pullets at the Ohio Experiment Station which were of the same age and had been fed alike, 50 of the best developed birds were placed in one pen and 50 of the least developed birds were placed in another. Both were given the same feed and care. The well developed birds began laying in October, while none of the underdeveloped birds began laying before December. The year's return above feed cost was $4.16 each for the early-maturing as against $2.45 for the late-maturing pullets.

Job 4. Feeding the Laying Flock

Conditions Usually Found.—(1) The average farm flock does not consume sufficient feed for profitable egg production. (2) The hens receive little or no grain while on range from early spring until late fall. (3) They do not usually receive sufficient green feed or its equivalent during the winter, nor sufficient animal protein and minerals. (4) In the northern states the working day of the hen during the winter months is too short. Many poultrymen are lengthening the day by means of artificial illumination.

Aims.—Poultry keepers should learn how to determine the following: (1) The nutritive requirements for egg production. (2) The combination of feeds which will give most economically the proper balance of nutrients. (3) Methods of increasing feed consumption. (4) Ways of providing for supplementary factors in poultry nutrition.

Problems for Study and Discussion.—(1) What use does the hen make of the feed she consumes? What nutrients are needed in order to produce eggs?

2. Why is the total feed consumed an important factor in economical egg production? What methods may be used to increase feed consumption?
3. How does the hen rank with other animals in efficiency as a food-producing machine?
4. What are the essentials of a complete ration?
5. What are the advantages of the all-mash method of feeding compared with the feeding of scratch grains and mash?
6. What purpose does animal protein serve in the hen's ration? What are the most economical sources? What forms are used locally?
7. What is the best method for your region of supplying green feed or its equivalent in the winter?
8. What poultry rations are used by farmers in your community? What feeding practices are used? Describe some of the good ones.
9. What are the functions of minerals and of grit?
10. What are the functions of vitamines in the body? Of direct sunlight?
11. Why is the length of the hen's working day important? How can it be lengthened?
12. What program should be followed in using lights on poultry? How should the use of lights with hens differ from that with pullets?

Activities.—(1) Mix feeds, according to best formulas, for laying hens. (2) Collect and label samples of many kinds of feeds. (3) Install lights for use with laying hens in winter. (4) Conduct feeding trials to compare methods and feeds, as (a) all-dry mash vs. adding one wet mash daily; (b) all mash vs. scratch feed and mash; (c) feeding with and without lights.

Importance of Amount and Kind of Feed Consumed.—The first use a hen makes of her feed is for maintenance. That is her first concern. It requires about three-quarters of the feed a hen consumes to furnish energy to keep her body active, heat to keep her warm, and materials to rebuild worn-out tissues.

The second use a hen makes of her feed is for the production of eggs. After the needs of the body have been supplied, if there is any feed left, it is used for making eggs. It is poor economy to feed just enough to maintain the body of the hen if our purpose is egg production. Many hens must live on a maintenance ration most of the year. Suppose the manager of a large shoe factory decided to manufacture shoes during the spring months and run his machinery empty for the remaining nine months in the year. We can readily see that such a procedure would be poor business policy because he must pay the cost of running the machinery without any returns in shoes with which to meet the expense. Many farm flocks are managed on about the same basis. Conditions are sufficiently favorable in the spring for production and the remainder of the year the egg machinery runs empty.

If the hen has the ability to produce eggs, all we feed above maintenance will be used in making eggs. It costs approximately as much to maintain the body of a 60-egg hen as the body of a 160-egg hen, but the cost of maintenance per dozen of eggs is much lower in the latter case. If the yearly feed cost of maintaining each of the above hens is $1.50 what would be the maintenance cost per dozen of eggs? One of our big problems in feeding is to discover ways of getting hens to consume more feed if we are to secure more economical production.

Importance of Proper Balance of Nutrients.—Another big problem is to get the right balance of feed nutrients. If the right materials are not available, the hen is unable to make eggs. Dryden says, "The egg contains one-quarter ounce of protein. If the hen be fed on wheat and nothing else, she may eat four ounces a day. Of that, she will need about three ounces to supply her body needs. This leaves one ounce of wheat with which to make eggs. In an ounce of wheat there is about one-tenth of an ounce of protein. Now supposing the protein is all digested, which is not the case, she will not get enough protein to make half an egg a day. But an egg every two or three days would not be so bad at certain seasons. The egg, however, contains other things. It contains also about one-quarter ounce of mineral matter, chiefly lime for the shell. An ounce of wheat contains less than one-tenth as much mineral matter as one egg of two ounces contains. The egg also contains fat. It contains less than one-quarter ounce of fat, while the ounce of wheat contains three times that amount."

What would be the result if the hen were fed on wheat alone? She would get enough protein to make an egg about every three days, enough lime to make an egg every 12 days, and enough carbohydrates and fat to make three eggs a day. What will the hen do in such a quandary? She cannot put more fat into the egg to make up for the lack of protein. She cannot make a counterfeit article and unless she has the right materials to make it with she will not make an egg. In order to make an egg, the hen will frequently take the lacking materials from her own body, thus weakening it for future production. While all the grains are unbalanced so far as the nutrients needed by the hen are concerned, it is possible to combine a number of them and secure the proper proportion of these nutrients.

Economical production is also influenced by feed prices. If the poultryman's only problem were to secure the highest egg yield feeding would be comparatively simple. But he is concerned with the profits from the eggs, which means that the cost of production must be kept at the minimum. This involves adjustments in the ration from time to time as feed prices change. With the cost of producing farm products constantly increasing, more attention must be given to the efficiency of the various domestic animals as human-food factories. The farmer has on hand bulky products in the form of grain and hay and he is interested in marketing these materials in a form which will bring him the greatest returns. This is especially important for farmers living far from market, where the cost of transporting bulky products is high. A crate of eggs can be shipped much cheaper than the grain which it takes to produce those eggs.

Fig. 202.—A busy place in winter. A winter scene in the interior of a poultry house. A well-bred flock is the factory wherein eggs are produced during the winter. Observe the arrangement of mash feeders, watering stands, and nests. (Ohio State University.)

The hen naturally ranks high in efficiency as a food producer. (Fig. 202). The table shows the efficiency of chickens compared with other animals.

Human Food Produced from 100 Pounds of Digestible Matter Consumed

Animal	Marketable product, lbs.	Edible solids, lbs.
Cow (milk)	139.0	18.0
Pig (dressed)	25.0	15.0
Cow (butter)	6.4	5.4
Poultry (eggs)	19.6	5.1
Poultry (dressed)	15.6	4.2
Steer (dressed)	8.3	2.8
Sheep (dressed)	7.0	2.6

While the hen ranks comparatively high in comparison with other animals some hens are more efficient than others.

Essentials of a Complete Ration.—The following list is given by Kennard of the Ohio Station:

1. Grains and their by-products such as corn, wheat, oats, bran and middlings.
2. An animal protein concentrate such as skim-milk, buttermilk, meat scraps, and tankage.
3. Minerals as supplied by meat scrap (50%), bone meal, or a mineral mixture.
4. Vitamines A and B as found in yellow corn, green feed, and immature cut clover or alfalfa hay.
5. The anti-rachitic factor or Vitamine D, which promotes health and aids in the prevention of paralysis, supplied by direct sunlight, cod-liver oil, or egg. Partial preventatives are green feed and immature cut clover or alfalfa hay.

How the Grains Should Be Fed.—Grain may be fed in one of three ways: (1) scratch grain and mash in varying proportions; (2) all mash and no scratch grain; (3) scratch grain and milk, but no mash. While all these methods have been tested at the experiment stations and found to give satisfactory results, each has its merits and disadvantages.

1. **The method of feeding scratch grain and mash** in varying proportions is most widely used at present, and no doubt will continue to be popular. Most of our state agriculture colleges and experiment stations have special rations which they recommend to the poultrymen of their respective states. Examples of these are the Cornell ration, the Ohio State ration and the Wisconsin ration. The Cornell and the Ohio State rations are as follows:

Cornell Laying Ration

Scratch grain	Mash
500 pounds cracked corn	100 pounds wheat bran
200 pounds wheat	100 pounds flour or wheat middlings
200 pounds barley	100 pounds yellow cornmeal
100 pounds heavy oats	100 pounds ground heavy oats or ground barley
	100 pounds meat scraps (50–55% fat)
	3 pounds salt

Ohio State Laying Ration

Scratch grain	Mash
200 pounds shelled corn or cracked corn	100 pounds cornmeal
100 pounds wheat or heavy oats	100 pounds ground oats
	100 pounds wheat middlings
	100 pounds wheat bran
	100 pounds meat scraps

What percentage of protein does each of these grain mixtures carry? The mash mixtures? The rations recommended by other states are very similar in composition. The scratch grain mixtures usually consist of the whole grains most commonly grown in the state and are deficient in proteins and minerals. The mash mixture consists of ground grains or grain products with the addition of animal protein and minerals. It is fairly high in proteins and minerals and is used to balance the grain mixture. The scratch grains are fed either in the litter or in open troughs and the mash in a self-feeder.

The method of feeding scratch grains and mash has its disadvantages, particularly the difficulty of knowing just what proportion of grain and mash should be fed. The grains are deficient in protein and minerals, and when they make up a large portion of the ration, as so frequently happens, too little mash is consumed to balance the grains with proteins and minerals. Most hens prefer whole grains and, when both are fed in the usual way, it is uncertain what proportion of grain to mash any individual in the flock is getting.

The Cornell Station advises the following feeding routine where this method is used:

1. The mash should be kept in the feeder available to the birds at all times.
2. The scratch grain should be fed as follows:
    - (a) Scatter in the litter 1 quart per 100 birds early in the morning.
    - (b) During the season of close confinement about 10 A. M. scatter small amounts in the litter to promote exercise. Keep the birds active during the forenoon.
    - (c) At least an hour before dusk scatter in the litter all the grain the birds will clean up.

The proportion of grain to mash should be governed somewhat by the kind of mash used. Where the mash carries around 20 per cent protein, it will require about equal parts (by weight) of grain and mash daily.

2. **The All-Mash Method.**—Recent experiments with Leghorns show that equally successful results can be obtained by feeding all the grain as mash. Experimental results at both the Wisconsin and the Ohio Stations show that the same mash can be used for day-old chicks, growing stock and laying hens. The Ohio and Wisconsin rations are as follows:

Wisconsin

80 parts of yellow corn
20 parts wheat middlings
5 parts raw bone meal (about 50% Cal. Phos.)
5 parts pearl grits
1 part salt

Ohio

65 parts ground yellow corn
20 parts wheat middlings
10 parts meat scraps
4 parts bone meal
1 part salt

The mash used in connection with scratch grains usually contains about 20 per cent protein in order to balance up the grain. Where the all-mash method is used, 10 or 15 per cent of protein is sufficient. When both milk and meat scraps are used, the meat scraps may be cut to 5 per cent in the mash. According to Kennard of the Ohio Station the all-mash method has the following advantages:

a. More sanitary—feeding grain in the litter is filthy. It has been demonstrated that, if a scratch mixture is used, it is just as satisfactory to feed in troughs (if exercise is provided).

b. Less skill in feeding is needed. All the skill that is needed is to keep feed in suitable feeders before the hens at all times.

c. Requires less labor.

d. Enables one to feed a definite ration. No guess-work about what proportion of scratch grain is to be fed.

e. No change in feed. You begin with mash with day-old chicks and continue through the laying period.

3. **Scratch Grain and Milk.**—Results at the Kentucky Station show that scratch grains with a liberal supply of milk give just as good results as scratch grain and mash. This has only limited practical application when a sufficient quantity of milk or skim-milk is not available. The method is commonly used in dairy regions.

Moistening Mash.—When feeding scratch feed, it has been the custom to send the hens to bed with a full crop. For this reason the main part of the scratch grain has been fed in the evening. Hens like grain and will eat freely. When the all-mash method of feeding is used, many poultrymen have found it advisable to give a feeding of moist mash in the evening. They moisten the mash with warm milk or water until it gets in a crumbly condition and feed in troughs. Eight to twelve pounds of mash before moistening will be readily consumed daily as moist mash by 100 hens during the winter months. It is advisable to discontinue the moistening of mash from April 1 until July when moistening may be resumed to maintain summer and fall production. Do not feed too much during July and August; 4 to 6 pounds per hundred hens is sufficient. Then, in September and October, they can be fed all they will consume in 30 minutes. The moistened mash should be fed between 4 and 6 o'clock, depending on the length of the days and whether or not lights are available.

Importance of Animal Protein.—The white of an egg is one of the purest forms of protein, and it is the raw materials for making this part of the egg which the farmer finds it most difficult to supply. If the hen has an insufficient amount of the right kind of protein, she will not lay eggs. Egg production can be controlled to a marked degree by regulating the sources of animal protein. Experiments show that protein of other plant origin will not supplement grain protein very efficiently. For example, linseed-meal and corn-meal proteins will not work well together. The same is true of other plant proteins such as soybean meal, cottonseed meal, and gluten feed. When the grain proteins are supplemented with proteins of animal sources, such as skim-milk, meat scraps, and tankage, the supplementing power is much greater and more of the protein is used. Studies at the Wisconsin Station revealed the fact that where a mixture of the proteins of corn and linseed meal showed an efficiency of growth of less than 40, skim-milk and corn showed an efficiency of 65.

Many experiments are being carried on in an attempt to discover how plant proteins may be used instead of the more expensive animal proteins. The results at the Ohio Station appear very promising. It is advisable, at present, however, for poultrymen to use animal protein until more data is available on the comparative efficiency of plant proteins.

Sources of Animal Protein.—Skim-milk, buttermilk, milk powder, tankage, meat scraps, meat meal, and fish meal are all sources of animal protein. Skim-milk should be used when available. A discussion of the value of semi-solid buttermilk and milk powder are given in Job 8.

Importance of Minerals.—Poultrymen have long realized the importance of supplying oyster shell as a source of lime for the egg shell. Recent experiments have shown that hens need more mineral matter with which to manufacture eggs than most poultry rations supply. It was formerly thought that if hens were not supplied with sufficient shell-building materials they would lay soft-shelled eggs. Experimental results at the Wisconsin Station show that in their trials there was no relation between the mineral supply and the number of soft-shelled eggs laid: if the ration was deficient in minerals, the hen ceased laying. Oyster shells should be kept before the hens at all times. Limestone grit should be supplied either in the mash or in a separate feeder. The Wisconsin mash calls for about 5 per cent of limestone in the mash. Additional minerals should be supplied in the form of raw bone meal, steamed bone meal, or calcium phosphate. Add 5 per cent to the mash.

Vitamins.—Little is known about these substances except that their absence results in malnutrition. Especially is this true of high-producing hens which are under an intense nervous strain.

Vitamin A is called the fat-soluble vitamin because it was first discovered in butter-fat. Its absence results in failure to grow and often in blindness. Recent experiments show a disorder called "nutritional roup," resulting from the lack of Vitamin A. Yellow corn, which is the basis of our poultry ration, is rich in Vitamin A.

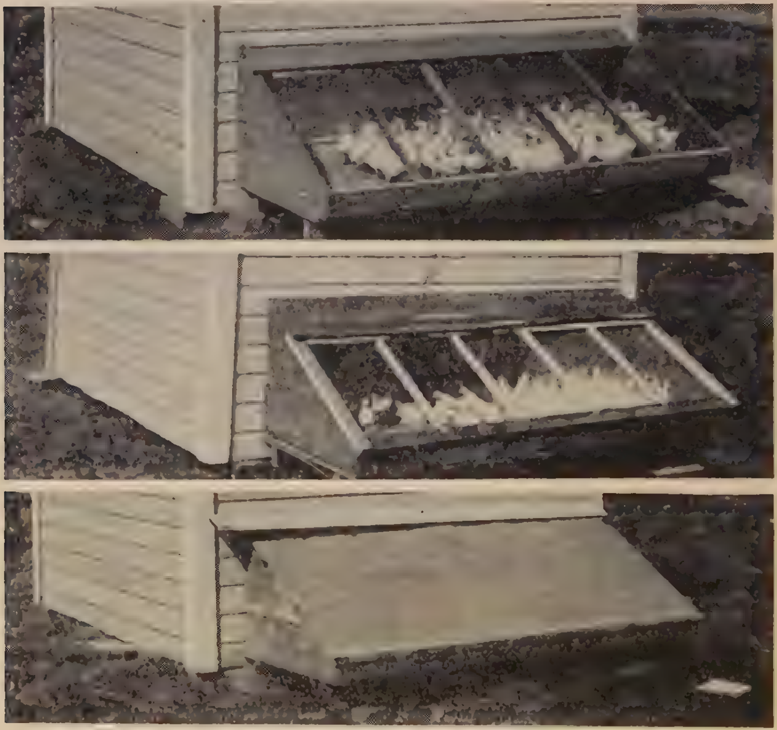


FIG. 203.—An experiment to show the effect of direct sunlight on the growth and development of chicks.

The three sun parlors covered with 1-inch mesh wire netting, window glass, and "celo-glass," in the order shown above. (Ohio Station.)

Vitamin B, a water-soluble vitamin, is found in the germs and seed coats of grains, in the juices of green plants and in skim-milk. Absence of Vitamin B arrests growth and produces nervous disorders in adult birds.

Vitamin C, found in cabbage and other plants and sometimes in milk, stimulates growth and prevents scurvy in animals subject to it.

When Vitamin D is lacking, rickets develop. The cause is an imperfect assimilation of the minerals (calcium and phosphorus) in the body. Vitamin D is found in cod-liver oil and in the yolk of eggs.

Sunlight performs the same function and is called the anti-rachitic factor. This action is similar to the effect of sunlight on assimilation in plants. When feeding chicks or laying hens, they must either be exposed to sunlight or fed something rich in Vitamin D. The ultra-violet rays are the only ones which are effective. These are strained out when sunlight passes through ordinary window glass. A specially made glass is on the market at present which does not strain out the ultra-violet rays.

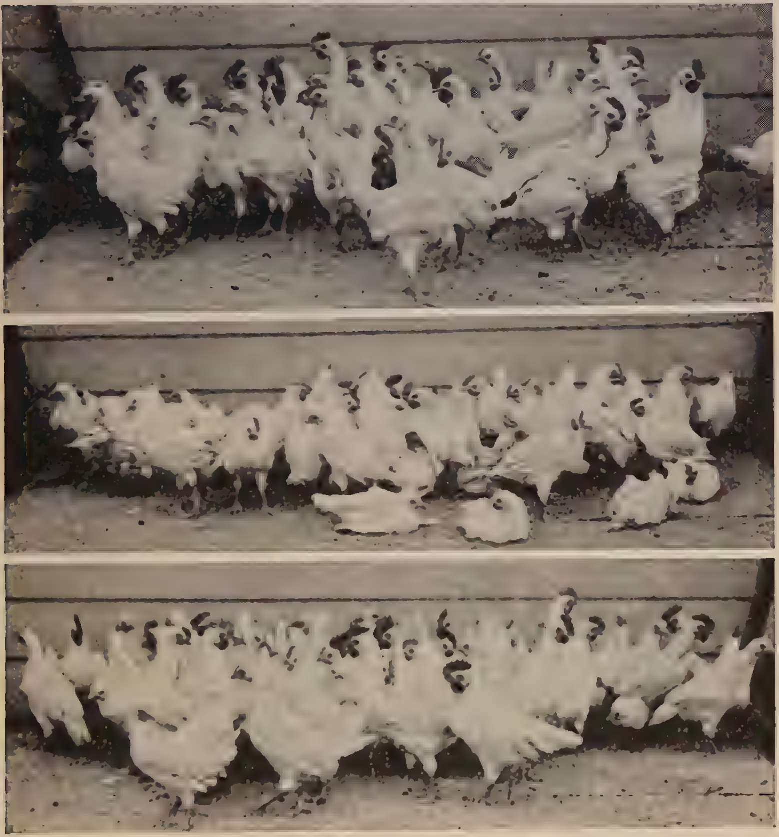


FIG. 204.—The first group of chicks in figure 204 received direct sunlight and were apparently normal. The second group received sunlight through window glass. All had leg weakness at seven weeks when photographed.

The third group received sunlight through "celo-glass," which enabled the chicks to make practically the same growth as those receiving direct sunlight. (Ohio Station.)

Steenbock at the University of Wisconsin has discovered a method of treating ordinary feed with ultra-violet rays so that it contains the anti-rachitic factor and will prevent rickets. This method has no commercial value at present but gives promise for the future.

At the Ohio Station three groups of chicks were placed in brooder houses to which sun parlors were attached (Figs 203 and 204).

Group I. The sun-parlor was covered with 1-inch mesh wire netting, thus exposing the chicks to direct sunlight. They developed normally.

Group II. The sun-parlor was covered with window glass. All had leg weakness at the end of seven weeks.

Group III. The sun-parlor was covered with celo-glass. The chicks developed similarly to those exposed to direct sunlight.

Recent experiments at the Wisconsin Station with sunlight and quartz mercury-vapor lamp on laying hens brought similar results. If sufficient sunlight cannot be provided, cod-liver oil should be fed. Add this to the mash at the rate of one or two per cent. This will decrease mortality and increase egg production.

Green feed or its equivalent is one of the vital parts of the ration for laying hens and it is frequently one of the most difficult to supply. In the summer this can be supplied by good range. After the range is depleted in late summer and fall, cabbage is the most easily provided. The winter supply is the most difficult. Experiments show that alfalfa, red clover or soybean hay gives satisfactory results. The hay should be cut when the plants are immature, to insure a large proportion of the green leaves which are rich in vitamins. It must be cured without getting wet and must be of high quality. The second or third cuttings of clover and alfalfa usually furnish the best quality. Soybean hay should be cured when the seeds are beginning to form in the pods. At this stage a large portion of the hay is leafy, palatable, and of a high protein content. The hay can be fed whole or cut. A satisfactory way is to cut the hay into half-inch lengths by passing it through a cutter. The cut hay can then be fed in a wire-netting basket feeder and kept before the hens at all times.

Water Supply.—The hens should have clean water accessible at all times. Water softens the feed in the bird's crop and other parts of the digestive tract. A hen's body is 55 per cent water, and eggs are 65 per cent water. The water should be kept as cool as possible in summer and much above freezing in winter in order to encourage the hens to drink freely.

How to Get Hens to Consume More Feed.—The number of eggs which a hen can lay is limited by the amount of feed she consumes. As has been stated, approximately three-quarters of the feed a hen consumes is used to maintain her body. If the hen is efficient, all above this will be used in making eggs. How can we get hens to consume more feed?

The amount of feed which can be consumed depends somewhat upon the length of her working day. The hen is a native of the tropics, where the days and nights are about equal in length. Her digestive system is not adapted to the short days and long nights of the northern winter and she stops laying because she cannot consume sufficient feed for both maintenance and egg production. At Columbus, Ohio, a hen has approximately 5½ hours more in her working day June 1st than she has January 1st. On June 1st she has approximately 14 hours of daylight and 10 hours of night. On January 1st she has 9½ hours of daylight and 14½ hours night. (Fig. 205). It requires approximately 11 hours to empty a full crop, and the remainder of the time the digestive system is inactive. Poultrymen have found it profitable to increase the length of the hen's working day by means of artificial lights, giving the hen 13 hours day and 11 hours night, which is more nearly normal. Professor

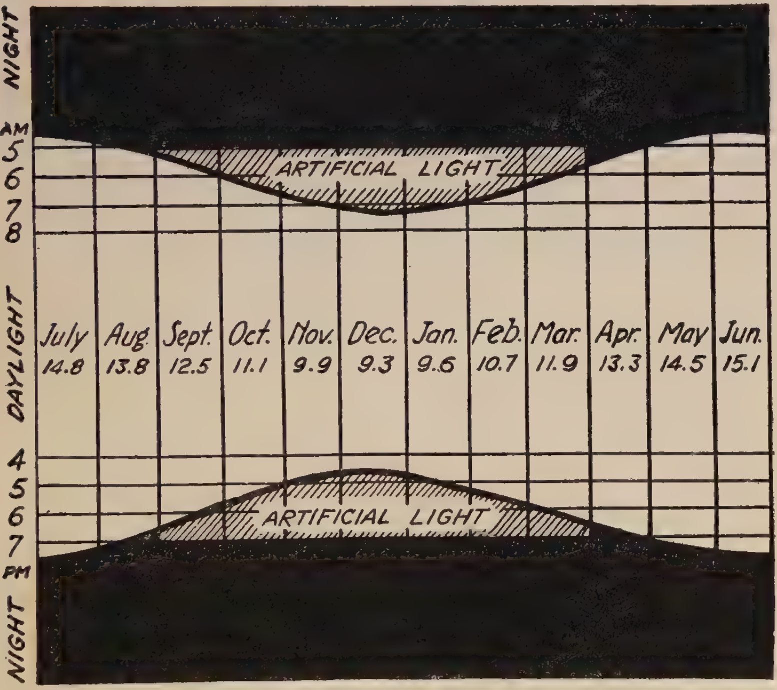


Fig. 205.—Change from light to darkness and darkness to light, during a year. Clock-hours are given at left.

Lewis at the New Jersey Station secured the following results with the use of lights:

No. of pullets		Profit per bird
600	Unlighted	$3.30
500	Morning lights	$5.07
100	Evening lunch	$5.48

The daily cost of providing artificial illumination was 4.4 cents per 100 birds.

Time of Day to Use Lights.—The two plans in most common use are: the morning system and the evening lunch system.

The Morning System.—Figure 205 shows how the hours of twilight and dawn change week by week throughout the year. The working day can be kept uniform by turning the lights on earlier each week to meet the shortening of the evenings. Lights may be turned on at 3:30 early in October and an 11-hour night maintained throughout the year. The morning system has the advantage of enabling the birds to make the best use of the lighting period since it follows the long night. Dimmers are not necessary as the lights are turned on and left burning until daylight.

The Evening Lunch.—The evening lunch consists of turning the lights on at 8 o'clock and allowing the hen to feed for from 1 to 1½ hours. It has the advantage of reducing the time between the feeding at night and the first feeding in the morning without reducing the time for sleep. Dimmers are needed when this system is used to enable the hens to find the roosts. Occasionally lights are used in both evening and morning, but the principles are the same.

How to Use Lights.—If the pullets are housed about October 1st, an attempt should be made to bring them into production by November 1st. Some poultrymen are using lights as early as September but this is likely to produce a molt in December and January. The lights should be discontinued in the spring (in April) when the days become 12 or 13 hours in length. If the yearling hens begin to molt in October and November, give them time to recover before using lights. They will usually be ready about January 1st.

For best results the pullets and hens should be in separate houses when lights are used. Why?

Other Ways of Stimulating Consumption of Feeds.—Factors such as palatability, wholesomeness, and the mechanical condition of the feed, affect the amount consumed. When a variety of the grains are fed, they are more likely to be palatable. Green feeds are palatable and influence the health of the birds because of their laxative effect. All feed should be clean and sweet and free from mold. If the all-mash method is used, the mash should be fed moist once daily. This will increase consumption.

Job 5. Housing the Laying Flock

Conditions Usually Found.—(1) Houses are often too small for the number of hens kept, poorly ventilated, poorly lighted, damp, and cold. Most of these houses can be remodeled and made satisfactory with very little expense. (2) Most farm flocks are allowed free range of the farm from early spring until late fall. (3) Many poultry houses are not kept clean and sanitary. (4) Chickens usually do not have access to satisfactory shade to protect them from the summer heat.

Aims.—Beginners should learn from a study of the nature and needs of the hen how to provide satisfactory housing and range conditions throughout the year. They should learn how to provide for these conditions when building a new house or remodeling an old one.

Problems for Study and Discussion.—(1) Why is it especially important to provide for an abundance of fresh air in a poultry house?

2. When observing a poultry house, how can you determine whether or not the ventilation is adequate? Is the ventilation adequate in poultry houses in your community? Compare the methods of ventilating these houses.
3. Why are hens so sensitive to drafts? How are drafts prevented in our poultry houses?
4. What points should be considered in locating a house?
5. What are the merits of the different types of houses?
6. How much floor space should be available for 200 Leghorn hens? For 100 Rhode Island Red hens? How much roost space should be provided for each type?
7. What provision should be made for direct sunlight?
8. What kinds of litter are satisfactory for the floor? What purpose does litter serve?
9. Why is range important? When should the laying flock be allowed free range of the farm?
10. What local poultry keepers allow poultry to roost in other places than in poultry houses? Name places.
11. What crops are suitable for supplying green material in poultry yards?

Activities.—(1) The class should visit a few of the best poultry houses in the community and make a study of the following points: size of the houses, number of hens wintered in each, square feet of floor space allowed per hen, feeding space at mash hoppers, number of nests, dropping boards, and roosting space. (2) Each student should draw a plan of his poultry house at home as it is at present. He should also draw up a plan to show how it could be improved by remodeling.

Essentials of a Poultry House.—A hen will lay best when she is comfortable and happy. To a large degree the comfort of the hen depends upon the kind of house she occupies. Rice says, "The hen home should be a place of comfort, safety, contentment, cheerfulness, and happiness. Given these, the hen responds." The house may be of simple design but should provide for an abundance of fresh air and sunlight and furnish protection against dampness, wind, extremes of heat and cold, filth and vermin, and other disturbing elements.

The Importance of Fresh Air.—Of the conditions which help make a hen confortable, pure air stands high in importance. When the amount of pure air is limited, a loss of vigor results. The hen is extremely active, breathes rapidly, and uses much more air in proportion to her size than other domestic animals. King gives the following figures on the number of cubic feet of air per 1000 pounds of live weight, breathed by different types of animals every 24 hours: cow 2804; horse 3401; and hen 8278. If the air is not pure, the hen must breathe faster in order to get a sufficient amount of oxygen. This fact, together with the rebreathing of air containing poisonous gases, tends to lower the hen's vitality. There should be a constant and positive displacement of the expired air by fresh air.

Poultrymen have frequently made the mistake of attempting to approximate summer temperature in winter by keeping the windows closed.

The poultry house cannot be both warm and dry in cold weather. If it is kept closed, the air will warm up in the daytime and cool down at night. Cold air will not hold as much moisture as warm air. When the air cools it condenses on the walls and makes the house damp. To try to keep the hen warm is impossible because, if we keep exchanging air rapidly by means of windows and other ventilators, there will be little difference between the temperature of the house and out of doors. Frozen combs are not so much due to cold air as to damp air. Why does it seem warmer in some western states at 20 degrees below than in others at zero?

While chickens need plenty of fresh air, they must not be exposed to drafts. Careless poultry keepers allow them to roost in trees when the wind is blowing. Even there they may not suffer seriously, but they take cold readily when exposed to a draft inside the house. The air in the poultry house must not only be pure but it must also be dry. Damp air compels chickens to increase their already rapid breathing. Lippincott says, "It is not uncommon for chickens confined in a damp house to pant on a day that is rather cold. This extra work of faster breathing uses up energy that should be employed in the production processes."

The Reason for the Rapid Breathing of Chickens.—This rapidity lies in the fact that the elimination of a large proportion of the body moisture must take place through respiration. While chickens do not drink as much water as other animals, there is no elimination by sweat glands, no urine is passed, and comparatively little is eliminated through the feces. The hen has a special system of eliminating moisture. She has four pairs of air-sacs and a median single sac besides a good pair of lungs. The sacs are connected with the lungs and make up a considerable proportion of the evaporating surface. The four pairs are distributed from the neck to the abdomen, and the single sac has a central location in the thorax. The cavities in the bones of the body communicate through these sacs with the lungs. Moisture from every part of the body is gathered through the whole system and finally expelled through the lungs. If the inhaled air is very moist, it will not take up much additional moisture from the body and the hen must breathe very fast and work unduly hard to get rid of waste.

Results of Poor Ventilation.—Poultrymen frequently keep the windows and other ventilators of their poultry houses closed in winter in order to keep out the cold air. The air soon becomes saturated with moisture. Colds result, which frequently are the beginnings of such epidemics as roup, diphtheria, catarrh, and kindred ills. Good ventilation should be provided without direct exposure to drafts.

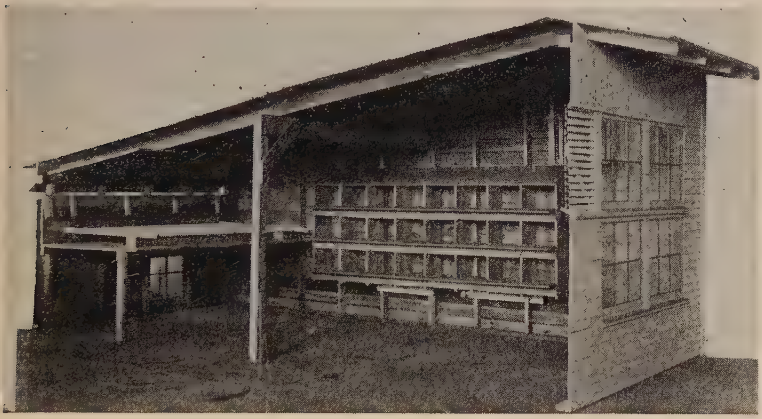


Fig. 206.—A laying house in cross-section. An interior view of a 20 x 30 shed-roof Ohio-type laying house. Observe the arrangement of the windows and lath baffle at the front, the nests on the side wall, the roosts and dropping boards in the rear, and the provision for ventilation above the roosts. In warm climates muslin and wire netting may take the place of lath and glass windows. (Ohio State University.)

Ventilating Systems.—Most ventilating systems depend upon a wide difference in temperature between inside and outside air for successful operation. Because of the large volume of fresh air needed by hens, it does not remain in the house for a sufficient length of time to be heated. For this reason, special ventilating systems have not been successful. Open-front, curtain-front, and slatted-front houses, supplemented by ventilators at the back of the house, have proven most satisfactory (Fig. 206).

Location of the House.—The poultry house should be located in a spot which is dry and well drained. A light, porous soil is preferable, as heavy clay soils are hard to keep sanitary. If the ground does not drain naturally, underdrainage should be provided. Damp ground makes a cold and unhealthful environment. If possible, locate the house on ground that slopes to the south. Face the house south in order to get the sun's rays throughout the day to keep the house bright and cheerful.

The house should be located near an abundance of shade, good range, and fresh pasturage. While the hen originally came from the tropics, she is unable to withstand the burning rays of the sun without the protection of trees and shrubs. If possible, locate the house near an orchard or woodlot. On the farm, it is good practice to fence the poultry out of places where they are not wanted and allow them free range elsewhere.

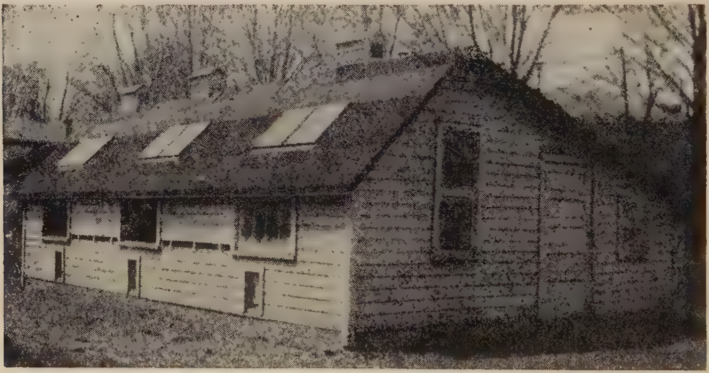


Fig. 207.— A 20 x 30 Michigan-type laying house used by the high school, Paw Paw, Michigan, to house a flock of 175 trap-nested White Leghorn hens, as a class project.

Type of House to Build.—There are several types of poultry houses in use at present, no one of which can be regarded as best for all conditions. Any type, to be satisfactory under a given set of conditions, must furnish adequate ventilation, admit as much sunlight as possible, be easily cleaned (Figs. 207 and 208) and disinfected, provide adequate space for the hens, be conveniently arranged, and be economical in cost.

The shed-roof type is the most universally used. It is simple to construct, comfortable for the hen, convenient for the attendant, and economical in cost. (Fig. 206). The single-unit houses are usually about 20 × 30 feet in size, 4.5 to 5 feet high in the rear, and 7.5 to 8.5 feet high in front. The structure is usually frame covered with matched drop siding and prepared roofing. Foundation and floors are usually made of concrete. A 20 × 30 house will accommodate 225 Leghorns or 180 birds of heavier breeds. For larger flocks, sufficient units may be built end-to-end to accommodate the entire flock.

The straw-loft house is gaining in popularity. These houses are commonly built square, 20 × 20, 40 × 40 or medium in size, with gable roof. Straw is used in the loft just under the roof, for insulation against heat and cold and to absorb moisture. In order to get sunlight properly distributed over the floor, windows are placed on three sides and frequently on the north side under the dropping board. Windows also open into the loft. The house is cool in summer, warm in winter, and comparatively dry. It is likely to harbor mice and rats and mites, which, when once established, are hard to exterminate.

A straw loft may be used in the shed-roof type, but with less convenience.

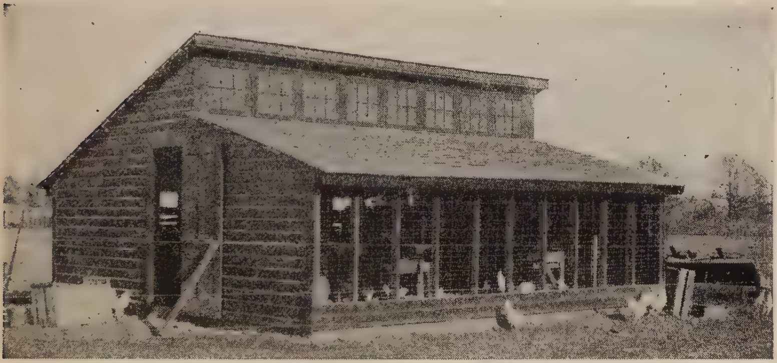


FIG. 208.—A poultry house built by a class in vocational agricultural high school at Metropolis, Illinois.

Size of House.—The size of the house is commonly expressed in terms of floor space. The amount of floor space to allow per hen depends upon several factors. Dryden says, "Where there is little or no snow or where chickens can be out every day in the year, two square feet of floor space per hen is sufficient. Where hens are out a small amount of time, from 4 to 5 square feet should be allowed." The size of flock is another factor. A flock of 50 hens should be allowed at least 5 square feet, while a flock of 150 may be allowed 4 square feet. Lewis reports the results of a survey of 150 New Jersey farms where the average of 3.9 square feet was allowed. Crowded hens are usually discontented and egg production is likely to suffer.

The amount of air space above the floor need not be considered; if the house is of a convenient height for the attendant, sufficient air space will be provided.

Floor and Litter.—The two essentials of a floor are (1) it must be dry; and (2) it must be easily cleaned. The concrete floor is the most sanitary and economical. Where it is used, care should be taken to see that it has the proper drainage to make it dry. This can be obtained by constructing a foundation of 6 to 8 inches of cinders, on top of which is placed 2 or 3 inches of coarse concrete, well tamped. A layer of tar building paper or a thin layer of coal tar, applied hot, should come next. On top of this apply one-half inch of finishing coat of 1 part cement and 2 parts sand. The floor should be higher than the surface of the ground and the surface drainage should be such that the water will not run toward the house.

Provision for Sunlight.—The windows should be so placed that sunlight will reach all parts of the floor of the house. Plenty of sunlight is essential because it acts as a disinfectant, and because it is necessary to expose the hen to the *direct rays* of the sun in order to aid the assimilation of minerals in her body and keep her healthy. Windows should be placed in front of the house and also under the dropping board in order to light all the floor area. Use one square foot of window glass for every 12 square feet of floor area. In addition, provide for one square foot of curtain space to every 6 square feet of floor area.

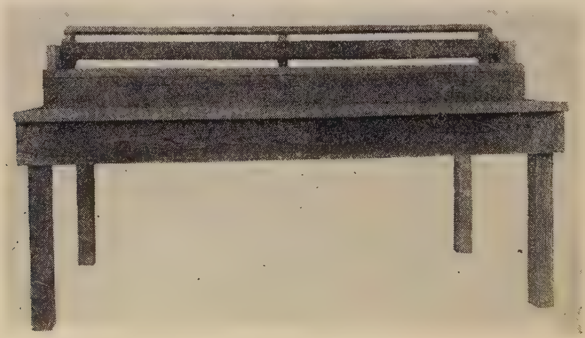


Fig. 209.—A convenient type of mash feeder. A portable mash feeder for use with laying hens. It is simple to construct and prevents waste, and the reel at the top prohibits roosting. (Ohio State University).

Interior Fixtures.—Every poultry house should be equipped with roosts and dropping boards, laying nests, self-feeders for mash and shell, and watering devices.

The roosts are usually placed at the back of the house, about 3 feet from the floor, with wire netting attached directly beneath. A dropping board should be placed about 4 to 6 inches below the roosts, extending

7 inches beyond the outer perch. This helps to keep the floor clean and prevents under drafts in the roosting quarters. The roosts should be hinged at the back so they can be raised while the dropping boards are being cleaned. Leghorns each require 6 or 7 inches of perch room; the heavier breeds need 8 to 12 inches.

Nest boxes should be hung on the side wall (Fig. 22). They should be roomy and easily cleaned and sprayed. For light breeds, 10 by 12 inches is satisfactory. The heavier breeds require slightly larger nests. One nest should be provided for every five layers.

A good self-feeder is essential. It should be large enough to hold several days' supply of feed, should provide a continuous supply, must not allow chickens to waste feed or roost on the top and should allow as much light on feed as possible. Figure 209 shows a very satisfactory type which can be easily made in the home shop. Write to your state agricultural college or experiment station and get plans recommended for a feeder (Fig. 210).

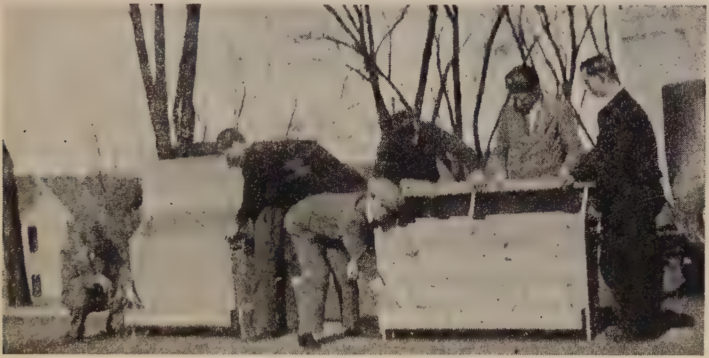


FIG. 210.—Mash hoppers built by students in farm mechanics at the high school, Waterloo, Wisconsin. (N. O. Eckley.)

Watering devices of many kinds are in use. Figure 211 shows a simple yet very satisfactory type. This is a slatted platform on legs made to hold an ordinary twelve or sixteen-quart pail at sufficient height to prevent the hens from scratching litter into it.

Constructing Poultry Houses.—Every poultryman in this country who is interested in building a new house or remodeling an old one may obtain assistance free. The agriculture college extension service in each state is equipped to furnish such assistance. Before building, it is always best to find out the most recent developments in poultry-house construction from the poultry specialists of your state.

In order to stimulate interest in modern housing methods, poultry-house-raising demonstrations are being held throughout the country (Fig. 212). Many old poultry houses can be made satisfactory at small expense. This should be done where possible because money invested in buildings and equipment is one item in the cost of producing eggs. In remodeling an old house, provision should be made for those conditions which will maintain the health and vigor of the laying flock. (Fig. 213.)

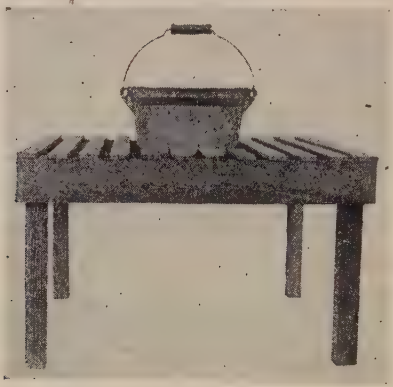


Fig. 211.—A sanitary slatted stand is made to hold a twelve- or sixteen-quart watering pail. It is of sufficient height from the floor to keep the water clean. The stand can be made longer to hold two pails if desired. (Ohio State University.)

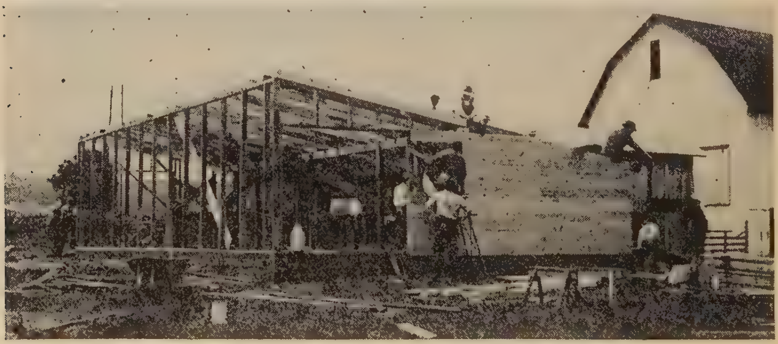


Fig. 212.—A poultry house raising. Through the combined efforts of the agriculture college extension service and the high school departments of vocational agriculture demonstrations are arranged where farmers may learn how to construct modern poultry houses. (Ohio State Univ.)

Yarding System.—Lippincott says, "In so far as possible, poultry should be fenced out rather than in. There is better thrift if the hens are fenced out of the graden and the door-yard and allowed free range on the farm." This eliminates poultry yards, which are expensive to fence and difficult to keep sanitary.

The commercial poultryman frequently uses a two-field system, allowing the hens to run in one field while the other is growing a crop. Rye, oats, rape, alfalfa, sweet clover, and other crops are used for pasturage.

Care of the House.—A house which has been occupied the previous year should be thoroughly cleaned and disinfected, as directed in Job 9, before the pullets are placed in it in the fall. This should be done at least a week before the birds are housed in order that the house may become aired and dry. Clean the nests, floor, and dropping board regularly, and spray the house thoroughly with crude carbolic acid and kerosene or any coal-tar disinfectant at suitable times. Place clean straw in nests and clean litter on floor.

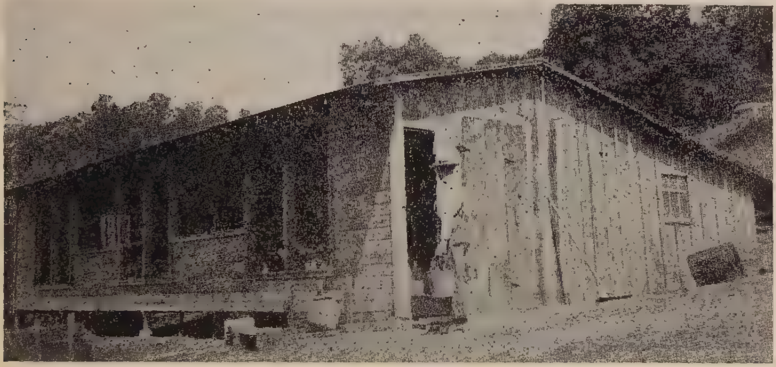


Fig. 213.—An old laying house remodeled. By building a new front to the old shed-roof house, it was made deeper and greater provision was made for fresh air and sunlight. In a similar way, many old houses could be made very satisfactory at small expense. (Ohio State Univ.)

Job 6. Breeding for Higher Production

Conditions Usually Found.—(1) Special breeding flocks are found on very few farms. In most instances the pullets and yearling hens are housed together, and hatching eggs are saved in the spring from the entire laying flock. (2) The average production per hen of farm flocks is low. Pullets are raised from the lowest as well as from the highest producers in the flock. The performance record of the ancestry of the male birds used is not always known. Mixed breeding is found in a large percentage of farm flocks.

Aims.—Breeders should learn how to obtain at the least cost a breeding flock of vigorous, high-producing hens.

Problems for Study and Discussion.—(1) Why should yearling hens be used for breeding rather than pullets? Under what farm conditions is it practical to manage the hens and pullets separately during the breeding season?

2. What is the most practical way for a small-flock owner to build up a good breeding flock? How many poultry keepers maintain special breeding flocks? Are any found in your region?
3. How do the methods of commercial poultrymen differ from those of small-flock owners?
4. Why is longevity an important quality in breeding stock? Why is the productive life of most hens only two years? How can the period be lengthened?
5. If the breeding and laying flocks are separate, how should the management of the two differ?
6. What factors affect the hatching qualities of eggs?
7. How does poor hatching of eggs affect the cost of chicks?
8. What are the marks of a good cock? How do most poultry keepers obtain their male birds? Give local practices.
9. How many males are needed for a breeding flock of 150 Leghorn hens? For 150 Rhode Island Reds?
10. How soon after mating may eggs be saved for hatching?
11. How many flocks in your neighborhood are headed by highly-bred cocks?
12. Find which breeders carefully choose hens to produce eggs for hatching. Compare local practices.
13. Suppose you need 200 pullets next fall. What should be the size of your breeding flock?

Activities.—(1) Take forms for keeping egg records to farms where the laying flocks are over a year old, and to farms where only younger layers are kept. Get them to feed alike and keep the laying records. Then compare the results by months. (2) If possible run such a comparison on your own or some other one place where the conditions and stock are alike. (3) Run a test to determine how soon eggs become fertile after first matings.

Essential Qualities of Breeding Stock.—Rice says that "because of the law that 'like tends to produce like' the selection of breeding stock becomes a very important step in raising the standard of egg production." While we may be certain that capacity for production in poultry, as in the case of other domestic animals, is inherited, there is very little experimental data available on poultry breeding at present to guide our practice. In selecting breeding stock, there are certain rules which the poultryman may follow. Select for high production, longevity, constitutional vigor, early production, late molting, persistence, and freedom from breed defects.

How to Build Up a Breeding Flock.—As pointed out in the discussion of culling the laying flock, in order for a hen to lay a large number of eggs in a year, she must have inherited the capacity for high egg production, must be able to consume a large quantity of feed above that needed for maintenance, and must lay over a long period. Pullets should begin laying in late October or early November and continue to lay through the next October. If we begin culling in June and cull out all birds which cease laying during June, July, August and early September, we shall eliminate the low producers or those lacking the vitality to withstand the heavy strain of high egg production and lay over a long period. This will probably reduce the flock at least 50 per cent. Only the highest producers should be retained. These hens should be used for the breeding flock the next season. They will molt during November and December and will be ready for laying by January 1st. They should be well fed and housed during this period, in order that they may come through the molt, regain their vitality, and be ready for another year's production.

Should Eggs from Pullets be Used for Hatching? This question has been raised by many farmers. Hatchery records show that where the pullets were well matured before beginning to lay, both the hatching qualities of the eggs and the vigor of the chicks were just as good as where the eggs were secured from yearling hens. It does not naturally follow that it is advisable to use pullet eggs for hatching. If a pullet begins laying in November and her eggs are used for hatching in March, this is too short a period to determine her persistence in laying, or her ability to withstand the heavy strain of high egg production over a long period. We need the summer and fall months to cull out the low producers. For this reason it is advisable to use as breeders hens at least one year old.

On a large percentage of farms, the pullets and yearling hens are housed together. Eggs from the entire flock are used for hatching. This is a doubtful practice. Where possible, it is much better to partition off one end of the laying house or use a brooder house for the yearling hens and feed and manage them separately. Even though pullets are raised from high-producing hens, there will still be a wide variation in their producing ability and the first year is needed to test out their persistence.

Production of Commercial Breeding Flocks.—The production and maintenance of breeding flocks is becoming a highly specialized enterprise. A few years ago practically all poultrymen maintained their own breeding flocks and hatched their chicks. At present, there is a tendency for more and more of them to buy day-old chicks and leave the problems of breeding and hatching to the specialist. This demand for day-old chicks from high egg-laying strains is responsible for the establishment of a large number of commercial breeding flocks throughout the country.

The poultry improvement associations in many of the states have plans for promoting this work in a very definite way. For example, the Ohio Improvement Association is supervising the trap-nesting of a large number of breeding flocks. The following rules and regulations are taken from the contract governing the "Ohio Record of Performance."

1. **Requirements for Flock to be Trap-Nested.**—(a) Only pullets or hens free from all Standard disqualifications and physical deformities that will affect their breeding qualities are eligible for trap-nesting under supervision of the Ohio Poultry Improvement Association.

(b) Each hen or pullet shall be passed by an authorized Association inspector, and be banded with the Association leg band, prior to December 1 of the official record year. After flocks are banded by the inspector, the owner has the privilege of withdrawing individual birds before December 1. All hens and pullets developing any Standard disqualifications during the trap-nesting year, which will affect their breeding qualities, shall be removed from the flock which is under supervision of the Ohio Poultry Improvement Association and shall have the leg band removed. Birds removed before December 1 may have substitutes put in their places with the approval of the inspector.

(c) Only Standard-bred birds are eligible for Record of Performance supervision.

(d) All birds entered in Record of Performance supervision must be banded with sealed leg bands, numbered and sold by the Ohio Poultry Improvement Association.

(e) To qualify for Record of Performance "approved" breeding flocks, birds must lay 200 eggs or more during the trap-nest year.

(f) The eggs of every bird must attain an average weight of at least 1⅞ ounces by February 1 of the first laying year and must be of proper shell color and texture. Birds which do not qualify in this respect must be removed from the trap-nest flock, and the Association leg band must be removed.

(g) The leg bands of all birds removed from the flock must be saved, and supplied to the official supervisor.

2. **Records.**—(a) The flock owner agrees to keep all records of trap-nesting, breeding, pedigreeing, disposal of stock, and any other records as required by the Association and approved by the Poultry Department of Ohio State University.

(b) Birds entered shall be trap-nested during the entire period of the official test. The official year shall be fifty-two consecutive weeks. The Association Record of Performance Committee shall designate the date for the beginning of the official year.

(c) Records may commence from the date a bird lays her first egg in the trap-nest, but the trap-nest year must be complete by December 1 of the following year. Records of birds starting to lay after December 1 will start December 1.

(d) Only eggs actually found in trap-nests shall be counted, and the flock owner shall record or cause to be recorded each egg as laid and shall keep posted in the house in which the birds are kept for the information of supervisors and others a record of same. If, under any circumstances, there is any doubt about an egg having been laid by a certain hen, it shall not be credited on the records.

(e) Floor eggs and other unrecorded eggs shall not be added to the individual record of any bird.

3. **Breeding Pen Requirements.**—(a) No bird, either male or female, shall be used in the "Approved Record of Performance" breeding pens other than

those which are free from all Standard disqualifications, and from physical deformities which will affect their breeding qualities.

(b) All females used in "Approved Record of Performance" breeding pens must have production records of at least 200 eggs in the official trap-nest year and be banded with the special approved Ohio Record of Performance leg bands.

(c) Separate matings must be established for each individual male unless full brothers are available.

(d) Birds owned and entered by Record of Performance flock owners in laying contests which are under the direction of the American Record of Performance Council are eligible for Approved Record of Performance breeding flocks providing they make an annual record of 200 eggs or more in the contest, and are not otherwise disqualified.

(e) Records on birds purchased by a Record of Performance flock owner from the Poultry Department of Ohio State University, or from the Ohio Experiment Station, will be approved by the Ohio Poultry Improvement Association on the same basis as records made in official contests.

All males used in "Approved Ohio Record of Performance" breeding pens must be individually pedigreed from hens with records of 200 eggs or more and must come from Record of Performance matings or other sources approved by the Poultry Department of Ohio State University. Males must be banded with special approved Record of Performance leg bands. Males to head "Approved Record of Performance" mating must meet the requirements laid down by the supervisor for color and breed type.

(f) The breeding pen shall be trap-nested during the hatching season and each egg shall be marked with the number of the hen that produced it.

(g) The Record of Performance flock owner must have certificates showing the qualifications of every hen in the "Approved Record of Performance" breeding pen.

(h) For males to be eligible to become "Approved Record of Performance" males, they must be individually pedigreed with wing bands. Toe-punching will not be accepted as positive identification of birds.

With the extension of this type of breeding program and a more general use of culling, we should be able to raise the flock average materially in the near future. This offers splendid opportunity for any one interested in the poultry business.

Longevity Important in Selection.—Why is the profitable life of a hen only two years? Trap-nest records show that a hen usually lays the largest number of eggs during her pullet year. The second year she lays slightly fewer, and after that ceases to be profitable. This makes it necessary to renew half the flock every year. There is no reason why the average profitable productive life of the hen should not be 4 or 5 years instead of two. This is possible because we find examples of good long-distance records. (Fig. 214). At the Oregon station 12 sisters laid, on an average, 211 eggs their first year, 200 during their second, and 188 during their third. A large expense would be eliminated if it were possible to renew half the flock every two years, instead of every year.

As one important step in fixing the quality of long life, hens should be selected for breeding which have produced at least two years and maintained the best of health.

Select for Constitutional Vigor.—Constitutional vigor is essential for longevity. The use of strong, vigorous birds results in higher egg production, better fertility and hatching qualities, and lower mortality in chicks. The characters indicating vigor are a short, thick, refined head (for the breed); a short, heavy, curved beak; a bright, prominent, inquisitive eye; a full, bright red comb. (Fig. 215). The body characteristics were discussed in detail under culling.

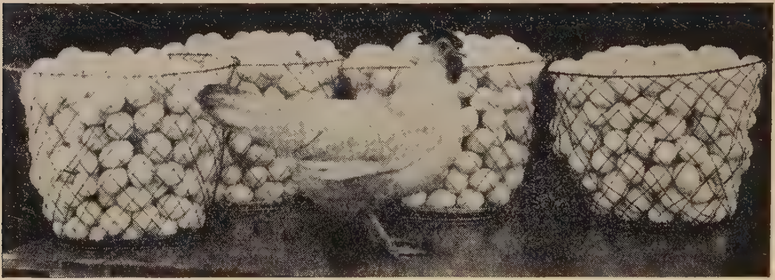


Fig. 214.—An unusual performance record. Missouri Ann and a graphic picture of the number of eggs she has produced during her lifetime. She has to her credit a yearly record of 200 eggs and a total record of more than 1000 eggs. It is significant that seven of her daughters have made records of more than 200 eggs a year. (Missouri College of Agriculture.)

Selection of Breeding Males.—The poultry sire, just as any sire, is half the flock. A sire worthy to head the flock should be pure-bred and should have a good pedigree. He should be directly descended from a high-producing hen and a tested sire. A breeding male should show marked vigor, alertness, and an active, commanding disposition. The head should be broad and deep, the beak short and well curved, the eye prominent, clear and bright, and the comb and wattles should be well developed, indicating masculinity. The neck should be short and the heart girth should be broad and deep. The body should be deep in front and at the center. Good males tend to be more shallow in the rear than females. The legs should be of medium length and well set under the body. Unlike well-bred hens, they tend to be narrow between the pelvic bones and show only medium abdominal capacity. They should be large for the breed, mature early, and be free from breed defects. Gallantry and good temperament are important qualities.

Management of the Breeding Flock.—The relation between the activity of the birds and the hatching qualities of the eggs is very marked. For good results, breeding stock must be kept on range. Where separate yards are not available, it is advisable to pen the laying flock and allow the breeding flock free range of the farm.

The feeding practices are similar to those discussed under "Feeding the laying flock." When the hens to be used for breeding stop laying and begin to molt, the amount of grain should be increased. Plenty of milk and green feed should be supplied. They should be ready to lay again by January 1. If lights are available, a small amount of artificial illumination can be used at this time and increased as the breeding season approaches. Blue-grass, clover, or alfalfa range will be a valuable supplement to the ration as soon as available. With a well-balanced grain ration, an abundance of green feed and minerals, good housing conditions, adequate range, and plenty of direct sunlight, the hatching qualities of the eggs and the vigor of the chicks should be satisfactory.

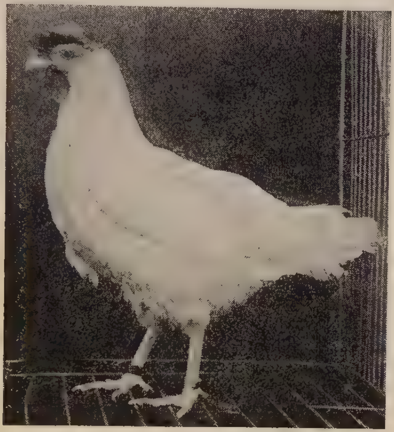


FIG. 215.—A hen that laid 287 eggs during her pullet year. Note the keen, refined expression, the prominent, bright, inquisitive eye and feminine characters. This hen shows the vigor and vitality required for high egg production. (Ohio State University.)

Mating the Breeders.—The birds should be mated two or three weeks before eggs are to be saved. Fertile eggs will be found after an active male has been with the flock two or three days, but it is not safe to save hatching eggs under two weeks. In farm flocks when an abundance of range is available, one male should be provided for each 15 to 25 hens in the lighter breeds and 15 to 20 in the general-purpose breeds. In flocks confined to a yard, a smaller number of hens should be allowed for each male.

Number of Breeders Necessary.—Rice suggests the following method of determining the size of the breeding flock:

"1. Allow 2 eggs for each chick to be hatched.

"2. Allow 3 chicks for each pullet to be reared.

"3. Allow 1 breeding hen for each 4 eggs per week expected during the hatching season."

Suppose a farmer desired 100 pullets; how many breeders will be necessary? Allowing 3 chicks for each pullet expected, he will need 300 chicks, and allowing 2 eggs for each chick hatched, he will need 600 eggs. If he has incubator capacity to hatch these all at once and saves the eggs over a period of two weeks, it will require 75 hens to supply a sufficient number of eggs. If the incubator is run at two different periods, 300 eggs each time, it would require only half the number of breeding hens.

Job 7. Securing Baby Chicks

Conditions Usually Found.—(1) The majority of poultry keepers obtain their pullets by hatching chicks with incubators or with hens and raising them to maturity. (2) A number buy day-old chicks from commercial hatcheries. (3) A few buy mature pullets.

Aims.—Farmers should learn (1) how to determine when to buy baby chicks and when to hatch them on the farm; (2) how to select and care for hatching eggs; and (3) how to run an incubator.

Problems for Study and Discussion.—(1) Should the average farmer hatch his chicks or buy day-old chicks? Which is more economical?

2. What is the approximate cost to your community of raising the needed pullets each year?
3. How will the method of handling the eggs from the time they are laid until they are placed in the incubator influence their hatching qualities and the the vigor of the chicks?
4. What is the most economical size of incubator to use where pullets must be raised each year? What sizes are used in your community?
5. What conditions are essential for incubation? In what respects may natural methods be duplicated through the use of an incubator?
6. What factors must be considered in choosing an incubator?
7. How do extreme temperatures affect the percentage of hatch and the vigor of the chicks?
8. What percentage of hatch do farmers in your neighborhood usually obtain?
9. Suppose you wish Leghorn pullets to begin laying by October first, when should the chicks be hatched?
10. How does frequency of turning eggs affect the percentage of hatch?
11. What are the most important problems in running an incubator?

Activities.—(1) Each student should visit a farm where an incubator is being used. Secure information on the following points: location of incubator; method of ventilating incubator room; size of incubator; method of heating and ventilating; how moisture is supplied; method and frequency of turning the eggs; method of candling eggs; percentage of hatch usually obtained. (2) Visit a commercial hatchery, if possible, and obtain the following information: how hatchery eggs are obtained; nature of supervision given flocks supplying eggs to the hatchery; type and make of incubator; incubator capacity; methods of heating, ventilating, supplying moisture, turning, candling, and cooling eggs; selling price of chicks; percentage of hatch usually obtained. (3) Run a test in a breeding flock to determine freedom from white diarrhœa.

Hatching vs. Buying Chicks.—Every poultry keeper must plan for a new supply of pullets each year to replace the two-year-old hens and cull pullets. How to obtain a supply of pullets each year is a serious problem. It costs from 75 cents to $1.50 to raise a pullet to maturity, the cost depending upon the mortality in hatching and brooding, price of feeds and the breed. We can realize the enormous total cost of raising pullets when we consider that one-half of each of the poultry flocks must be replaced every year. At $1.00 each how much does this cost your community?

Some poultrymen find it more economical to buy pullets than to raise them when they can be bought in August or September for from $1.00 to $1.50. The supply of mature pullets, however, is limited, and most poultry keepers must raise them. How to obtain the chicks presents a real problem in poultry management. Should the farmer who needs 125 pullets buy day-old chicks, or should he hatch these chicks with an incubator, or should he hatch them with hens? If we allow three chicks for each pullet reared, it would require 375 chicks to raise 125 pullets. How many hens would be needed to hatch this number of chicks? What should be the capacity of the incubator to hatch these chicks at one time, allowing for a 50 per cent hatch? Figure the cost of hatching chicks by both natural and artificial methods.

While a large percentage of the chicks on the farm are still hatched with hens, this method is very unsatisfactory for the following reasons:

1. Hens are very unreliable. This is especially true of the egg breeds.

2. The date of hatching cannot be controlled but varies with the season. If we plan to have pullets mature in time for winter egg production, they must be hatched at the right time.

3. A sufficient number of broody hens cannot be obtained to have a large percentage of the chicks hatch at one time. It will be necessary to feed and manage chicks of different ages throughout the summer and the pullets will not mature uniformly.

4. Hens are out of production while they are hatching and brooding the chicks. A larger number of eggs incubated together makes a more economical unit so far as the labor of the operator is concerned.

Lippincott says: "The time has passed when the question of the desirability of having an incubator on a farm is any more debatable than the desirability of having a cream separator, seed tester, or any similar piece of modern farm equipment."

If we hatch 375 chicks artificially, they should be hatched at one time because it is more economical to brood 375 chicks together than to brood them in two groups. This would require an incubator of 750-egg capacity, which means a fairly large investment. It also requires considerable skill to operate an incubator properly.

It is possible to buy day-old chicks of almost any breed in any number from a few dozen to several thousand. The hatchery business has developed to the point where day-old chicks can be purchased for from 12 to 20 cents apiece, the price depending upon the breeding of the flocks from which the hatching eggs are obtained and the time in the hatching season. Farmers and commercial poultrymen are taking advantage of this and are buying their chicks instead of hatching them. By so doing they get chicks of the same age, which simplifies brooding. Chicks can be shipped long distances without injury (Fig. 216). They get them when they want them and are willing to leave all the work and risk of hatching to the specialist. When buying chicks make sure to look up the business standing and integrity of the hatchery.

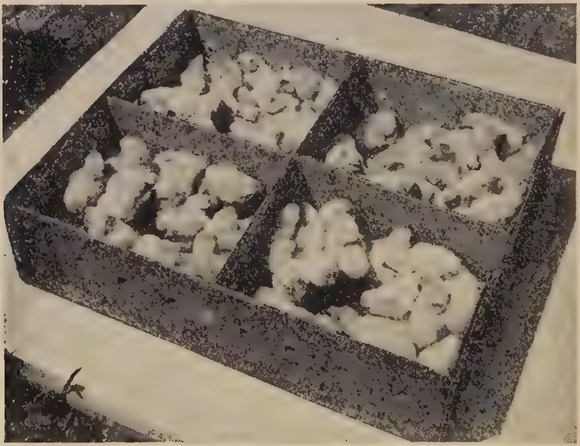


Fig. 216.—Baby chicks ready for shipment. Chicks may be shipped long distances without injury. No feeding is required for the first 60 or 72 hours. The heat from their bodies when nestled prevents chilling, even in cold weather.

Accrediting of Hatcheries.—Most of the Poultry Improvement

Associations in the various states have plans for accrediting hatcheries within their respective states. The object of accrediting is "to promote, foster, and encourage the production of high-quality baby chicks from selected flocks; to handle coöperatively and collectively the problems of hatchery owners; and to insure baby chick purchasers a high quality product."

Requirements for Accredited Hatcheries.—1. Set eggs only from accredited flocks.

2. Follow such measures regarding sanitation and cleanliness at the hatchery as the field manager may prescribe. (The field manager is employed by the Poultry Improvement Association.)

3. Inspect all chicks carefully before shipment and sell none as accredited chicks except those that are strong, healthy, and true to name.

4. Not to buy chicks for re-sale except from another accredited hatchery.

Requirements for Accredited Flocks.—1. Each flock selling eggs to an accredited hatchery must be culled by an inspector licensed by the Poultry Improvement Association.

2. Accredited birds must be banded at the time of inspection with an Association sealed leg band.

3. Only standard-bred birds that are vigorous, in good health, and free from Standard disqualifications shall remain in an accredited flock.

This system of accrediting flocks and hatcheries, together with the supervision of the Records of Performance of breeding flocks, should result in more vigorous, high-producing laying flocks.

When to Begin Hatching.—Chicks should be hatched at such a time that the pullets will mature in time to produce early winter eggs. This depends somewhat upon the breed, climate, and rearing conditions. The egg breeds should be hatched from April 1 to May 15 in the northern states. The heavier breeds should be hatched at least one month earlier. If hatching is delayed longer, hot weather makes brooding more difficult. April-hatched Leghorns frequently begin laying early in August. Maturity can be retarded by decreasing the amount of animal protein in the ration.

Selection of Hatching Eggs.—Hatching eggs should be graded rigidly. Large eggs produce large chicks and small eggs produce small chicks. They should be uniform in size, shape, and color and be free from ridges or weak shells. No eggs should be incubated which weigh less than two ounces. This is important because the future pullets are likely to produce similar eggs.

The problem in incubation is to secure the largest possible number of strong, vigorous chicks. In order to do this the chick should not be handicapped at any stage from the time the egg is laid until the chick is hatched.

The condition of the shell is very important. The developing chick draws upon the shell for a large part of the lime necessary for growth. It is porous and permeable to gases. This permits evaporation of water in the egg, and the entrance of oxygen necessary for the development of the embryo. Breeding hens should be constantly supplied with oyster shell or other lime. Breeders believe that plentiful lime makes the egg-shells strong and not likely to crack under ordinary handling. They should be laid in clean nests. Hatching eggs should not be washed, as this destroys the cuticle or bloom and hastens evaporation. Eggs should be gathered frequently, not less than twice daily, especially during cold weather.

Care of Eggs.—They should be kept in a dry place and held at a uniform temperature between 50 and 60 degrees. Germ growth begins at 68 degrees, and much below 50 degrees may chill and weaken the germ.

The eggs should be turned at least once daily. The interior of the egg is made up of the yellow yolk and the white albumen. The yolk, with the germ spot uppermost, being lighter, tends to float on the albumen. When left in one position for a considerable length of time, the yolk moves upward until the germ side of the yolk comes in contact with the shell membrane. As evaporation takes place, the embryo adheres to the shell and is destroyed. When eggs are turned frequently the yolk remains suspended in the albumen.

Some poultrymen follow the practice when buying eggs for hatching of disinfecting them by dipping in a solution of 92 per cent alcohol, or in a 2 or 3 per cent solution of a standard stock dip. They should never be rubbed.

Essential Conditions for Incubation.—Whether eggs are hatched with hens or with an incubator, there are certain conditions which must prevail.

1. The temperature must be normal and regular.
2. There must be plenty of fresh air but no direct drafts over the eggs.
3. The eggs must be turned frequently.
4. There must be sufficient moisture to retard evaporation from the eggs.

If possible, eggs should be incubated the same week they are laid. They should not be held more than 10 days to two weeks at the most. Recent experiments at the Maryland Station to determine the effect of age of eggs on hatching qualities gave the following results:

0–10 days, 55.14 per cent hatched
11–20 days, 41.77 per cent hatched
21–28 days, 17.94 per cent hatched

When these conditions are met, there is practically no difference in hatching efficiency between the hen and the incubator. Man, through the use of the incubator, has been able to duplicate natural conditions, and is much more reliable.

Choice of an Incubator.—Incubators are usually classified according to methods used in providing for heat, such as hot air, hot water, and electricity. There is no difference in efficiency under the direction of a careful operator. Farm incubators range in size from 50 to 450 eggs. The mammoth incubators used in hatcheries are built in sections and hold as many as several hundred thousand eggs. When buying an incubator, select a standard make and the size to meet your particular needs. Many small incubators are made in sections so that as more capacity is needed new sections may be added.

Preparing the Incubator for Use.—A sanitary incubator is a large factor in preventing chick diseases. Every hatching egg should have a chance in a sanitary machine. Remove the trays and wash them thoroughly in a 5 per cent solution of any good disinfectant. Spray the interior of the incubator. This should be done even though it has been disinfected the previous season. Let it dry thoroughly. See that the lamp is clean, the wick is of sufficient length, and the burner and gauze free from foreign material. Incubators are usually kept in a basement room. It should be dry and should not be subject to changes in temperature during the day and night.

The incubator should be started and the thermostat regulated so that a constant temperature of 103 degrees can be maintained at least 24 hours before the eggs are placed in the machine.

Operating the Machine.—Preserve the directions which come with the machine and follow them carefully.

Temperature.—The proper hatching temperature is about 103 degrees Fahrenheit at the top of the egg. This is about the average temperature under the setting hen. During the latter part of the incubation period the temperature is slightly higher, due to the heat given off by the chicks. The incubator may be started at 102½ and gradually raised to 103. The temperature must be kept steady. It should be uniform at all parts of the egg tray. The danger from improper temperatures is not so much the loss of chicks that fail to hatch as of low vitality in those hatched.

Ventilation.—Not only the incubator room but the incubator itself must have good ventilation in order to remove the impure air given off by the growing embryos, and to supply them with oxygen. Where good ventilation is provided, moisture must be supplied in order to prevent undue evaporation from the eggs. Where no provision is made in the incubator for supplying moisture, the humidity is usually maintained by restricting the ventilation. This may result in a weak hatch.

Supplying Moisture.—When the air surrounding the eggs is dry, evaporation takes place through the shell of the egg. If we increase the difference between the temperatures of the incubator room and the interior of the incubator itself, the ventilation will be increased, and more moisture will be necessary. There are two ways by which the loss of moisture may be determined: (1) by marking a dozen eggs and weighing them every six days; (2) by observing the size of the air space in the egg when candling.

Moisture may be supplied in several ways: by placing a tray of moist sand under the egg tray; by placing a pan of water under the egg tray; by sprinkling the eggs with warm water; by sprinkling the floor and walls of the incubator room.

Fig. 217.—A picture of health. A tray of newly-hatched, vigorous, lusty chicks ready for the brooder. Healthy, vigorous development should result under proper methods of brooding.

Turning and Cooling the Eggs.—After the second day, the eggs should be turned at least twice daily. Follow the directions of the incubator manufacturer. Avoid all drafts and sudden chilling. Turning should be discontinued after the 18th day.

Recent experiments seem to indicate that special cooling, other than that received by the eggs at turning, is unnecessary. The eggs should be allowed to cool until they no longer feel hot to the hand but not until they feel cold.

If proper conditions of temperature, moisture, and ventilation have been maintained, the hatch should result in a high percentage of strong, vigorous chicks (Fig. 217).

Candling the Eggs.—The progress of the hatch should be watched by candling the eggs. Some operators candle on the 7th, 14th, and the

18th days respectively, while others candle only twice. On the 7th day an infertile egg will appear clear except for the slight shadow which is distinguished as the yolk, while the fertile egg appears as a spider-like mass. It floats about freely in the contents of the egg when rotated. A dead germ shows a slight blood ring. All infertile eggs and those with dead germs should be removed and saved for feed.

The second test is made at the end of the second week. This time only dead germs are left to test out. The live embryo at this time nearly fills the egg.

Taking off the Hatch.—Hatching takes place on the 21st day. As soon as the chicks begin to pip, the moisture pans should be removed and the aperture to the nursery opened. The incubator should be darkened and left closed until the hatch is over.

Culling should begin with the chicks in the tray. Small and weak chicks should be discarded. No cripples should ever get away from the trays.

The chicks should be left in the incubator without feeding for 36 hours and as much longer as is necessary to show hunger. As soon as the chicks are dry, the temperature of the incubator should be reduced from 103 to 95 degrees by slightly opening the door. The reason for delaying the removal of the chicks is to secure as complete yolk absorption as possible. The yolk that remains unused is absorbed through the navel and acts as a food supply for several hours.

Job 8. Brooding Chicks and Management of the Young Stock

Conditions Usually Found.—(1) Chicks are brooded with hens on a large percentage of the farms in the United States. The number using artificial methods of brooding is increasing from year to year. Most commercial poultrymen use artificial methods of brooding. At present the mortality in brooding chicks artificially is very high. (2) Chicks are not usually provided with sufficient milk, green feed, mineral matter, and sunlight. The brooder house is frequently located from year to year on the same ground, where the chicks do not have access to grass or natural shade. (3) Young pullets are frequently kept under crowded conditions in late summer.

Aims.—Beginners should learn how to raise to maturity the largest number of strong healthy chicks, at the least cost.

Problems for Study and Discussion.—(1) Under what conditions would you advise a farmer to use natural methods of brooding? Artificial methods? What percentage of farmers in your neighborhood brood chicks artificially? What types of brooder stoves do they use?

2. What provision should be made for direct sunlight? How can Vitamin D be supplied when sufficient exposure to direct sunlight is not possible?
3. At what age should chicks be allowed to get out-of-doors?
4. How can you determine when the brooder temperature is correct?
5. How is green feed supplied? What is its function?
6. Outline a feeding program for the first six weeks.
7. How would you prepare the brooder house for young chicks? The brooder stove?

8. What factors should be considered in locating a brooder house?
9. What are the most common chick troubles? How may crowding be prevented?
10. At what age should cockerels be sold for broilers?

Activities.—(1) Each student should visit one or more farms and study the conditions under which artificial brooding is being done. Obtain information on the following: size and type of brooder house; temperatures maintained; methods of feeding; size and type of brooder stove; provision for direct sunlight, range, green feed; chick troubles and mortality. (2) Obtain samples of commercial chick feeds and study their composition. Compare their costs with those available on the farm. (3) Compare brooding with and without direct sunlight.

Giving the Chicks a Good Start.—After hatching the chicks, our next task is to raise the largest possible number of them to maturity. The brooding period is a very crucial time in the life of a growing chick.

Fig. 218.—An ideal environment for brooding chicks. A comfortable brooder house, on clean ground, a blue-grass range and plenty of shade make an ideal environment for brooding chicks. (Ohio State University)

From 40 to 50 per cent of the chicks on the average farm die before reaching maturity and many others are so weakened that they do not develop normally. What are the most common causes for such losses? With vigorous breeding stock and proper hatching and brooding methods this loss should not exceed 15 or 20 per cent.

Recent studies show that chicks improperly brooded rarely produce as many eggs and never possess the health and vigor as the same quality of chicks properly brooded. If satisfactory results are to be obtained, certain practices must be followed.

Ohio's Big Ten Rules for Raising Chicks.—1. Hatch early.
2. Prepare the brooder house and move it to clean ground.
3. Provide sufficient brooder-house space and large enough stove.
4. Do not feed too soon, and give proper care to young chicks.
5. Feed a wholesome, well-balanced ration.
6. Feed large amounts of milk.
7. Provide green feed liberally at all times.

8. Get chicks outdoors as soon as weather permits.
9. Rear young stock away from old stock.
10. Separate cockerels from pullets as soon as possible.

Essential Conditions for Brooding.—Chicks should be reared on clean ground free from intestinal worms and disease germs. It is advisable to move the brooder house each year to fresh ground, on which poultry has not run for at least two years, and where there is a good sod, as clover, alfalfa or blue-grass. Bare yards should never be used unless they have been limed, plowed, and sowed to some crop. Both shade and range are essential. A grove or an orchard with plenty of shade, with a blue-grass range, and away from the old stock, makes an excellent environment for brooding. This can best be accomplished by using a portable brooder house, which can be moved from year to year (Fig. 218).

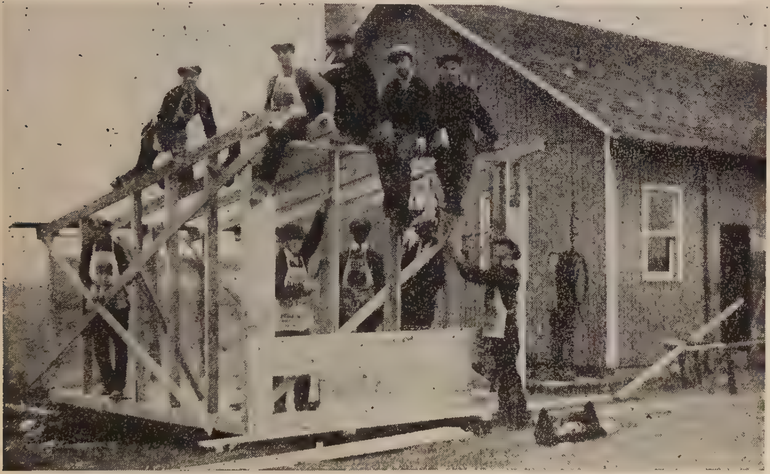


FIG. 219.—Boys in vocational agriculture learning to construct poultry houses. A 10 x 12 Ohio-type brooder house under construction by a class in Agricultural Engineering at York Township Centralized School, Van Wert County, Ohio. (L. W. Adam.)

The brooder house should be of sufficient size to permit of good ventilation and to allow chicks room to get away from the brooder stove and into cool air. When planning the size of house it is well to allow approximately one square foot of floor space for each four chicks. How many chicks would the 10 by 12 shed-roof-type portable house shown in figure 219 accommodate?

The floor and sides of the house should be tight to prevent drafts. For the first few days the lungs of the chick are protected from the outside air only by the down and thin skin on its back. This makes it very sensitive to changes in temperature and especially to drafts.

Where from 400 to 500 chicks are kept together in a brooder house, that means a great many lungs calling for fresh air or oxygen. The demand is small at first but increases every day. Provision is made for ventilation in the brooder houses shown in figures 220 and 221 by windows in the front and sides and muslin space in the front. The upper window sash is hinged at the bottom and opens in at the top, in order to deflect the cold air upward. The house provides approximately 20 square feet of window glass space and 6½ square feet of muslin space. The muslin window may be replaced by glass in case the house becomes too cold.

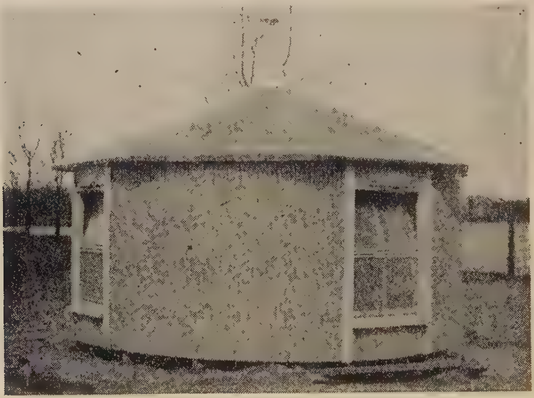


FIG. 220.—A brooder house fourteen feet in diameter used for brooding a class project of five hundred pedigreed White Leghorn chicks by the high school vocational agriculture class at Paw Paw, Michigan.

The house should be equipped with a brooder stove of sufficient size and reliability to maintain the proper temperature.

Choice of a Brooder Stove.—The chick is hatched in the incubator at a temperature of 103 degrees. Since the normal temperature in the spring is much below this, the delicate chick must be provided with some form of artificial heat. Artificial brooders and stoves are on the market which range in capacity from 50 to 1000 chicks. Most stoves are overrated as to capacity, and consequently it is usually advisable to buy the larger sizes.

This is particularly true if brooding is done in the early spring, when the weather is cold, because they have great fuel capacity and hold fire through the night better than the smaller ones.

Oil and coal are the most common sources of heat. Natural gas and electricity are being used to a limited extent. Coal brooders have the greatest heating capacity and are usually considered the most reliable. A metal canopy or hover at the top of the stove deflects the heat to the chicks' backs, where it is needed, instead of allowing it to rise to the ceiling. The drafts of the stove are opened and closed by an automatic regulator or thermostat.

Preparation of the Brooder House.—Unless the brooder house is new, it should be thoroughly cleaned, sprayed with some coal-tar disinfectant, and whitewashed. This will eliminate all disease germs, lice, and mites. If cracks exist in the floor or side walls, they should be covered with wood strips or roofing paper. The floor should be covered with one inch of clean sand or dry soil. The sand absorbs moisture from the droppings, and makes the floor warmer and more easily cleaned. For the first few days, the floor near the heater should be covered with one-half inch of litter, such as clover or alfalfa leaves or hay cut in inch lengths. Make sure that this material is not moldy. After that, the entire floor may be covered with clean cut straw. The corners of the house should be filled with straw or rounded off by using wire or roofing paper so that the chicks cannot get into these corners. The crowding of chicks into the corners causes many deaths.

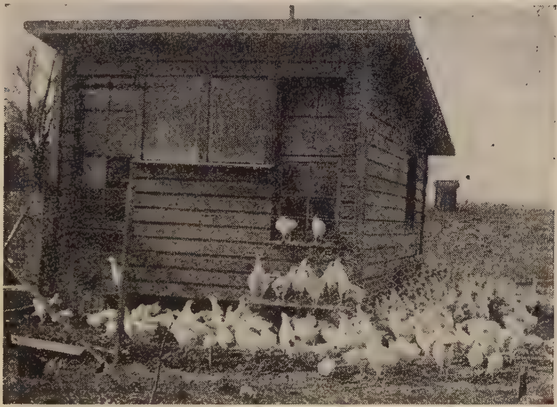


Fig. 221.—A satisfactory type of brooder house. A 10 x 12 Ohio-type portable brooder house in use by a vocational student in his chick-rearing project. The house was built by the class in agriculture engineering and is large enough to accommodate from 400 to 500 chicks. (Layever Leghorn Farms.)

The brooder should be overhauled and started at least two days ahead in order to have it properly regulated before the chicks are placed in it. When the chicks are put in the house, the temperature should be about 100 degrees, one foot from the stove and about two inches above the floor. As the chicks grow, this temperature may be decreased 5 degrees per week until artificial heat is entirely discontinued. If the weather is cold at first, an enclosure should be arranged about two feet from the hover around the outside to confine the chicks close to the heat. Wire netting, roofing paper, or boards 12 inches wide and of sufficient length to surround the hover may be used.

Regulating the Temperature.—While the thermometer will be found useful as a guide in determining the proper brooding temperature, the safest guide is the behavior of the chicks. The skilled poultryman knows from the appearance of the chicks whether or not they have sufficient heat and fresh air. If the chicks pant, the temperature is too high and the ventilation is insufficient. If the temperature is too low, they will crowd together. Chick comfort is indicated by the chicks lying singly or in small groups around the edge of the hover, with their wings spread and their heads resting on the litter.

Feeding the Chicks.—Chicks should be given nothing to eat or drink for at least 48 hours after the hatch is completed; and some prefer to wait 72 hours. The exact time will be determined by the chicks calling so lustily as to leave no uncertainty about their being hungry. It has been found that when feeding is delayed the yolk material which is taken into the body just prior to hatching is more satisfactorily absorbed.

The fact that the yolk furnishes a feed supply for two or three days makes it possible to ship baby chicks long distances without feeding. If chicks are hatched at home, it is a good plan to leave them in the incubator until time to feed. If the chicks are purchased, they can be left in the chick boxes until feeding time. Make sure they do not get over-heated or chilled.

Feeding experiments have shown that chicks must have a balanced and complete ration if best growth is to be obtained. The essentials of a complete ration for growing chicks are very similar to those suggested for laying hens. Briefly they are as follows:

1. Grains and their by-products.
2. Animal protein.
3. Minerals.
4. Vitamines A and B.
5. The anti-rachitic factor or Vitamin D.

How the Grains should be Fed.—The grains may be fed in two ways. (1) As scratch grain and mash. (2) As all-mash.

1. **The feeding of scratch grain and mash** is most widely used at present. Most state agricultural colleges and experiment stations have chick rations which they recommend to the poultrymen of their states. The Ohio ration is as follows:

Scratch grain

First six weeks	
Fine cracked corn	200 lbs.
Cracked wheat	100 lbs.
Pinhead or rolled oats	100 lbs.
Six weeks to maturity	
Cracked corn	300 lbs.
Whole wheat	100 lbs.
Milk to drink at all times	
Green feed every day	

Mash

First week	
Bran or standard middlings	
Second week to maturity	
Yellow cornmeal	200 lbs.
Bran	100 lbs.
Standard middlings	100 lbs.
Fine limestone or pearl grits or oyster shells	25 lbs.
Raw granulated bone	25 lbs.
Salt	5 lbs.
Meat scraps	100 lbs.
(When milk is available it can replace the meat scraps)	

During the first ten days scratch grains should be fed four or five times daily. For the first few feedings the grain may be fed on paper and after that in the litter. After ten days the number of feedings may be decreased until the chicks are on range, when the grain may be hopper-fed.

The bran and middlings should be available during the first week in shallow pans or hoppers. After this the mash should be kept before the chicks at all times. If the weather is such that the chicks must be confined to the house for several weeks, one quart of cod-liver oil should be mixed with each 100 pounds of mash. This supplies the Vitamin D which is necessary for the assimilation of minerals, thus preventing leg weakness. Infertile eggs mixed with moist mash will perform the same function.

2. **All-Mash System.**—During the past two years the chicks at the Wisconsin and the Ohio Experiment Stations have been raised on all mash and no scratch grain from day-old chicks to mature pullets. The results showed well-developed, vigorous pullets in October, and the mortality was exceptionally low. The following mash was used at the Ohio Station:

Mash Mixture

Ground yellow corn	72 lbs.
Winter wheat middlings	20 lbs.
Meat scraps	5 lbs.
Raw bone meal (chick size)	2 lbs.
Salt	1 lb.

Skim-milk (sweet or sour) or buttermilk was given to drink instead of water during the first 10 or 12 weeks.

The advantages of the all-mash method of feeding chicks are similar to those given for feeding laying hens. Many farmers in Ohio are using this method and have secured satisfactory results. A few have reported that their pullets were thin and that it was necessary to feed some scratch grain during September and October in order to get them ready for laying.

Where pullets appear thin in the fall, they should be fed sufficient grain to enable them to lay on a supply of fat in preparation for their long period of egg production.

Feed Consumption and Growth.—The question is often asked by poultry keepers, "How much feed is required for a chick to a certain age and what should the chick weigh?" The following table gives the

FEED CONSUMPTION (INCLUDING MILK SOLIDS) AND WEIGHT OF CHICKS AND PULLETS BY WEEKS*

Week	White Leghorns		Rhode Island Reds	
	Feed per bird	Weight per bird	Feed per bird	Weight per bird
	Lb.	Lb.	Lb.	Lb.
0	....	.08	....	.08
1	.09	.11	.10	.11
2	.28	.18	.29	.16
3	.57	.26	.56	.26
4	.94	.38	.95	.36
5	1.42	.50	1.48	.53
6	1.96	.69	2.18	.73
7	2.71	.90	2.96	.96
8	3.51	1.09	3.94	1.22
9	4.41	1.22	4.95	1.52
10	5.40	1.41	6.02	1.80
11	6.45	1.56	7.15	2.01
12	7.53	1.80	8.39	2.29
13	8.64	1.93	9.62	2.39
14	9.74	2.06	10.83	2.56
15	10.93	2.20	12.14	2.76
16	12.11	2.36	13.58	2.90
17	13.54	2.49	15.17	3.13
18	14.93	2.63	16.82	3.26
19	16.38	2.72	18.38	3.43
20	17.91	2.90	20.12	3.68
21	19.39	3.05	21.89	3.85
22	20.83	3.12	23.68	4.00
23	22.29	3.22	25.41	4.16
24	23.84	3.28	27.24	4.29

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* Storrs Agricultural Experiment Station Bulletin 96.

averages of three experiments with a total of 1028 White Leghorns and 865 Rhode Island Red chicks. The birds had skim-milk but no water to drink during the first ten weeks, after which both milk and water were supplied. An outdoor range was provided.

Feeding Animal Protein.—Milk is the best source of protein yet discovered for chicks. Its use results in better growth and reduces mortality. It should be fed for at least eight weeks, and, if available, it should be fed all summer. If milk is available, nothing else should be given to drink. It should be the first thing the chicks receive when put into the brooder. Skim-milk and buttermilk are equally effective. Skim-milk may be fed either sweet or sour.

Earthenware vessels or wooden troughs make good containers for milk. Galvanized vessels should never be used. Purifying agents, such as corrosive sublimate and permanganate of potash, should not be placed in the milk. When neither skim-milk nor buttermilk is available, semi-solid buttermilk or some form of powdered milk may be used. Semi-solid buttermilk may be fed by spreading it with a paddle on boards or around the walls of the house where the chickens can reach it. It may also be fed as a drink by thoroughly mixing three pounds of the semi-solid buttermilk in one gallon of water. One pound of dried milk equals about three pounds of semi-solid buttermilk or one gallo of liquid milk for feeding purposes. When considering the purchasing of either form of milk product, it is well to consider the relative prices of each.

FIG. 222.—An ideal poultry project. A vocational student and his 360 Leghorns at eight weeks of age. Blue-grass range and plenty of shade are ideal conditions for growing young stock. (Layever Leghorn Farms, St. Clairsville, Ohio.)

Provision for Green Feed.—While the chicks are confined to the house they should be given green feed at all times. Green clover, alfalfa, blue-grass, dandelions, rape, and lettuce are excellent. The root crops furnish succulence but except for carrots are low in vitamin content.

Provision for Range.—As soon as the weather is sufficiently warm for the chicks to be out on the ground, they should have a range on such crops as blue-grass, alfalfa or clover. If possible, they should be out for at least part of the day after the first week or ten days. Exposure to sunlight is the simplest method of stimulating vigorous growth and preventing leg weakness (Fig. 222). Confine the chicks to a small yard at first and enlarge it as they grow. As long as they are still young, it is desirable to keep them confined in the morning until the grass is dry.

Separation of Cockerels and Pullets.—This should take place at about 8 or 10 weeks of age. At this time the cockerels should be large enough to be finished for broilers (Fig. 223). The earlier this can be done and still have them reach a marketable weight, the higher will be the price. They should be placed in the fattening pen for one or two weeks and then sold. This will provide more room in the brooder house for the pullets. If any cockerels are needed for breeders, the most promising ones should be saved and allowed to run with the pullets.

FIG. 223.—Easter broilers. Leghorn broilers, ten weeks of age, on blue-grass range. An orchard just north of the buildings furnished plenty of shade. The whole family is interested in the project. (Richard Willeke.)

Summer Management of the Young Pullets.—Pullets should remain on free range, where there is plenty of green feed and bugs, until they are fully mature and have stored up a surplus supply of body fat. (Figs. 224 and 225.) There should be plenty of shade on the range, which may be provided by trees and bushes. As the pullets become larger, many of them will forsake the hot, crowded brooder house and roost in the trees. This need not be discouraged, for the tree is the most economical and the most healthful summer poultry house.

Poultry keepers should plan to have pullets mature and begin laying about the 1st of October. It is sometimes advisable to force the growth

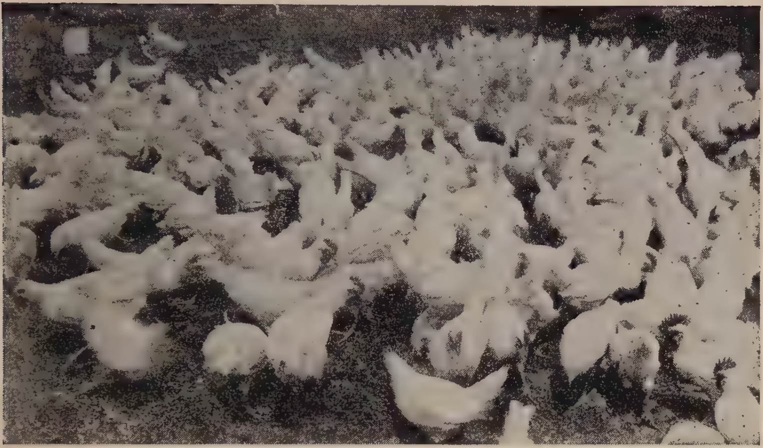

FIG. 224.—A fine prospect for pullets. This flock of 470 Leghorns was raised from 500 baby chicks by a vocational student in his project. Mortality should be low where modern methods of brooding are followed. (Chester Ebersole.)

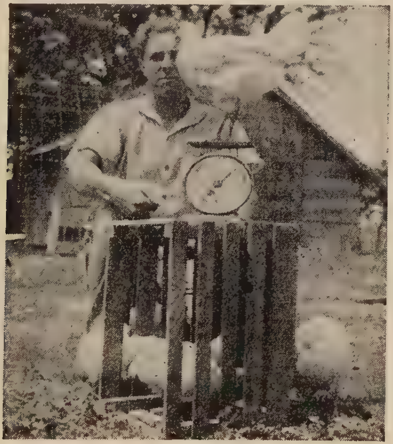

FIG. 225.—Large, vigorous, growthy pullets make the best layers. Maynard Secore developed white Wyandottes weighing two and three-quarter pounds at nine weeks of age. He is a student in vocational agriculture at the High School, Eaton Rapids, Michigan.

of late-hatched, slow-growing pullets by increasing the feed consumption. This can be done by feeding wet mash once each day. Wet the mash with milk until it is just crumbly and feed in open troughs.

When pullets mature in July or August, egg production should be delayed by removing the animal protein from the ration. They should be fed only scratch grain and given water to drink. This will enable them to store up some surplus fat which conditions them for winter egg production. Pullets should be placed in the house about October 1st and fed for egg production.

Chick Troubles and Their Control.—There are many troubles which cause heavy losses in brooding chicks, most of which could be avoided. Only the most common troubles will be discussed here. A more detailed discussion of parasites and diseases is given under Job 9.

Ordinary Diarrhœa.—This is principally due to overheating, chilling, overfeeding, feeding too soon, or feeding spoiled feed. The chicks appear listless, sleepy, and the wings droop. The feathers around the vent become pasted with a whitish material. There is a loss of appetite, chicks fail to grow and may die at night under the hover.

After chicks have diarrhœa, they should be given a dose of Epsom salts at the rate of four ounces to a gallon of water or milk. Get chicks outdoors or place sod in the house. Supply plenty of green feed.

Bacillary White Diarrhœa.—This is an infectious disease, transmitted to chicks through the eggs of infected hens. The symptoms are very similar to those caused by ordinary diarrhœa, and in fact one is often mistaken for the other.

Most of the mortality usually occurs during the first week, although losses may continue for three or four weeks longer. There is no known cure for chicks having the disease.

The method of control generally recommended is to remove infected hens from the breeding flock. Such hens can be distinguished by a blood test or a bacterin test in the wattles.

Crowding is usually caused by chilling, over-heating, or fright. It happens most frequently about dusk when the chicks are distributing themselves on the brooder floor for the night, or sometime during the night if the brooder stove becomes extremely hot or cold.

The following precautions should be observed:

1. Do not attempt to brood more chicks together than the brooder and house will accommodate.
2. Round off the corners of the house.
3. Put the chicks to bed early by spreading them out on the floor and darkening the windows.
4. Get the chicks on roosts as early as possible.

5. Attempt to maintain a uniform temperature in the brooder house throughout the night.

Leg Weakness.—One of the most common causes of leg weakness is the improper assimilation of mineral matter due to the lack of Vitamin D or sunlight. This results in soft and undeveloped bones which are unable to support the body of the chick and rickets follows.

Recent experiments have shown that when chicks are exposed to direct sunlight this trouble is prevented or remedied. Sun shining through ordinary window glass is of no value because the ultra-violet rays which are necessary for the assimilation of minerals in the body are strained out (Fig. 203 and 204).

It is advisable to get chicks outdoors as quickly as possible. If chicks cannot be allowed out within two weeks, cod-liver oil or infertile incubator eggs should be fed. As soon as chicks are out in the sunshine this may be discontinued.

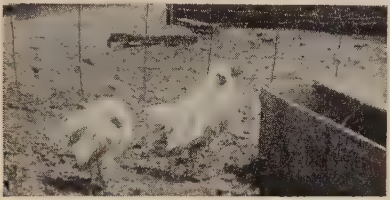

FIG. 226.—Chicks affected with coccidiosis. Infected chicks act droopy, the wings sag, and in severe cases the droppings are bloody. Where chicks are reared on the same ground year after year, it becomes infested with disease germs. Rear chicks on clean new sod. (Ohio State University.)

Coccidiosis.—This disease is caused by an organism which works in intestines and causes large losses. It is a highly infectious disease and usually occurs between the ages of two and ten weeks. A microscopic examination of the intestines is the only definite method of diagnosis. The infected chicks act droopy and become thin. The wings sag and, in some infections, the droppings are bloody. (Fig. 226).

The disease should be prevented by rearing chicks on clean, new sod. After the disease appears, feed heavily on sour milk. Feed lightly on other feeds. Give Epsom salts every other morning at the rate of four ounces to a gallon of water or milk. Clean and disinfect the brooder house thoroughly and move to clean ground.

Cannibalism.—Chicks naturally like to pick at something and, when carried to the point of producing blood, they never stop until the chick is killed. This usually occurs with chicks that are inactive and kept under crowded conditions. Feed plenty of milk and green feed and get the chicks outdoors as much as possible.

Gape Worms.—Gapes are caused by small worms which attach themselves to the lining of the windpipe and cause strangulation by closing the air passage. They come from infested ground and can be prevented by rearing chicks on fresh sod. They may be removed by the use of a horsehair, and complete recovery follows.

Methods of control of intestinal worms, lice, and mites are given under Job 9.

Job 9. Controlling Diseases and Parasites

Conditions Usually Found.—Poultry diseases and parasites cause large losses every year because of the unsanitary condition of the houses and yards. Houses are not cleaned regularly and frequently become filthy. Ventilation is inadequate. The ground around the poultry houses is infested with disease germs and parasites. Sick birds are not always isolated before they infect the whole flock. Dead birds are not always destroyed.

Aims.—Young farmers should learn the nature of the most common poultry diseases and parasites in order to be able (1) to maintain the conditions of sanitation and hygiene necessary for the health of the flock; and (2) to treat sick birds when infected.

Problems for Study and Discussion.—(1) What diseases and parasites cause most losses in your community?

2. What are the most common causes of diseases among poultry? How can these be remedied?
3. How would you handle an outbreak of a contagious disease? How would this differ from handling an infectious disease?
4. What are the external symptoms of tuberculosis? What symptoms would a post-mortem reveal?
5. In what ways may a flock become infested with tuberculosis? How are flocks tested?
6. How can you distinguish between nutritional and contagious roup?
7. Many hatcheries advertise baby chicks from flocks tested for bacillary white diarrhœa. Does this guarantee chicks free from the disease?
8. Why are some flocks more susceptible to disease than others?

Activities.—(1) Secure a few hens which show signs of being infected with internal parasites. Perform a post-mortem and study the parasites found. (2) Perform a post-mortem examination to study tuberculosis. (3) Collect specimens of lice, mites, worms, gapes, tubercles; preserve these in small bottles with 5 per cent formalin; label each. (4) Practise disinfecting poultry houses, nests, roosts and poultry by different methods and compare results.

Importance of Sanitation.—While remarkable progress has been made in recent years in the control of poultry parasites and diseases, the poultry keeper must rely on preventive measures rather than on curing diseases in order to maintain his flock on a healthy, profitable basis. It is an unprofitable business to be continually fighting diseases and treating sick fowls when most of these troubles could be avoided by providing proper sanitary and hygienic conditions.

Impure air frequently results in the loss of vigor. Diseases of the respiratory organs, such as catarrh, roup, and colds, thrive best in poorly ventilated houses. It is useless to treat for these diseases when fowls are kept under such conditions.

Next to fresh air, clean ground is the best preventative of disease. Ground around poultry houses on which chickens run from year to year is usually badly infested with disease germs and parasites unless it has been limed and cropped. Diseases affecting the intestines, such as tuberculosis, cholera, and coccidiosis, thrive in unclean ground and the germs are picked up by the chickens while feeding. The same is true of many parasites, such as intestinal worms and gapes.

The poultry house should not be allowed to become a breeding place for disease germs and parasites. Lice and mites in an infested house soon sap the vitality of the hens and curtail production. No flock of chickens, however carefully managed, can be kept entirely free from parasites and diseases. In spite of the best sanitary conditions, diseases will sometimes get into the flock and make remedial measures necessary.

Disinfecting the Poultry House and Yards.—The poultry house should be thoroughly cleaned and disinfected at least twice each year, in the fall and spring. In the fall, this should be done before the pullets are housed, the first of October. The dropping boards should be cleaned and all litter and straw removed from the floor and nests. The walls, ceiling, and floor should be swept clean. The feed hoppers and watering devices should be emptied and cleaned. The interior of the house, including the floors and all the fixtures, should then be sprayed with crude carbolic and kerosene (one part to three), or any coal-tar disinfectant. Then with a paint brush apply carbolineum or engine oil to the perches, perch supports, and interior of the nests. The windows should be washed, the nests filled with clean straw, and the floor covered with litter. The house should be thoroughly cleaned again in the spring, and at any time when any infectious disease occurs.

Manure should be removed from the dropping board at least once each week. The straw in the nests and litter on the floor should be changed as frequently. Use oil often on roosts, in nests, and on floors to keep down mites.

The permanent laying house cannot be moved to clean, fresh ground, as is recommended for the brooder house. For this reason the ground around the house should be limed, cultivated and cropped. There is no better way to purify a soil than to open it up by cultivation and let the sunlight in and to grow crops upon it.

Pure air, fresh ground, and a clean house are the poultry-keeper's best insurance against disease.

Lice.—Whenever birds begin to show lack of thrift, it is well to suspect lice and to make an examination. If present, they can be most easily found around the vent and under the wings. They possess biting mouth parts and irritate the bird by crawling around and by biting the old scales which serve as food. The eggs are laid around the bases of the feathers. Their entire life is spent on the fowl.

Treatment.—Either of the following methods should be satisfactory.

1. *Sodium Fluoride.*—Hold the bird, head down, and scatter a few pinches of the powder through the feathers of the breast, on each side of the back, below the vent, and on the head and neck.

2. *Blue Ointment.*—With the finger apply a piece about the size of a pea under the vent, at the base of each wing, and on the head.

Red Mites.—Mites, if present, may be found in the daytime on the under sides of the roosts or in cracks and crevices nearby. At night they crawl on the birds and fill themselves with blood, piercing the skin with their sucking mouth parts. Before morning they crawl back on the roosts, where they spend the day. When full of blood they appear red, but when empty they are grey in color. They breed very rapidly in warm weather.

Treatment.—Spray the house with crude carbolic and kerosene (one part to three) or some coal-tar preparation, and paint the roosts, nests and floors with carbolineum or engine oil. The house should be inspected frequently during the year in order to discover the mites if they are present.

Intestinal Worms.—Flocks infested with intestinal worms are becoming very numerous and as a rule are unprofitable. Young stock are affected more than mature stock. The worms prevent normal growth and development and are the cause of many stunted and runty pullets. Infested birds become thin and walk with an unsteady gait. The only sure way of diagnosing the trouble is to take a suspicious bird (Fig. 227) kill it, and slit the intestines from one end to the other, looking closely for worms of several sizes.

Treatment.—For light infestations, add two pounds of fine tobacco dust containing 1½ to 2 per cent nicotine to each 100 pounds of mash. Mix thoroughly. If the infestation is heavy, use the following mixture for each 100 birds. Take one pound of tobacco stems or clippings, cover with water and cook for two hours. Starve the birds for 12 to 15 hours. Then feed a moist mash containing the cooked tobacco stems and juice. Follow in four hours with a dose of Epsom salts, one pound to four gallons of water. After this keep two per cent of tobacco dust in the mash.

In treating tapeworms, take a gallon each of wheat and oats, cover with water and add one large tablespoon of concentrated lye and cook for two hours. Starve as described and feed all of this cooked mixture that the birds will eat. Follow with Epsom salts.

Tuberculosis.—Tuberculosis among fowls is becoming a serious disease in the northern states. The affected bird becomes thin with pale comb and wattles, and finally grows so weak that it is unable to move about. A post-mortem will show small yellowish spots on the liver and spleen and sometimes on the intestines. Fowls become infected by eating feed and soil on which germs from the droppings of tuberculous fowls are deposited.

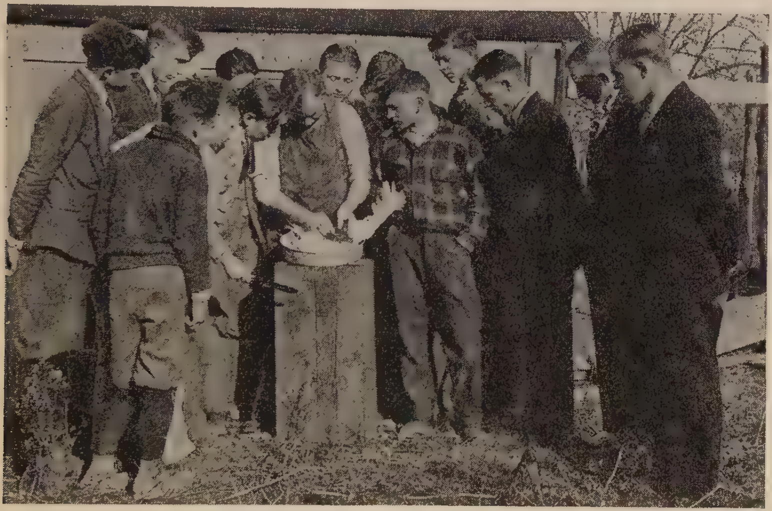

FIG. 227.—A Post-Mortem Demonstration. A class in vocational agriculture at Hilliard, Ohio, studying internal parasites and diseases of poultry through a post-mortem examination.

Treatment.—The disease is incurable. All infected birds should be killed and burned. The diagnosis in the living fowl is possible by means of the tuberculin test, which is made by injecting tuberculin into the skin of the wattle. The wattle will swell within 48 hours if the bird has tuberculosis.

Roup.—This is a highly contagious disease affecting the nose, eye, and throat. The symptoms are the same as for severe colds, namely, watering eyes, swollen eyelids, and loss of appetite. It is usually caused by drafts, improper ventilation or dampness. This condition should be remedied as soon as possible.

Treatment.—All affected birds should be placed in a house that can be well ventilated. Give them plenty of fresh air but do not permit drafts to pass over them. Give them water to drink in which has been dissolved Epsom salts at the rate of one pound to four gallons of water. Repeat this every third day.

If individual treatment is needed, paint the affected area of the head with tincture of iodine or dip the head in a solution of potassium permanganate which is made by dissolving one teaspoon of potassium permanganate in one gallon of water. Feed lightly for a few days, giving only grain. After the disease has been checked, the hens can be placed on their regular laying ration.

Cholera.—This is a highly contagious disease, although not so common as tuberculosis and roup. The symptoms are diarrhœa, loss of appetite, and pale comb and wattles. Death occurs within a short time.

Treatment.—All sick birds should be killed and burned. The quarters should be thoroughly disinfected. There is no successful cure known at present.

Job 10. Keeping Poultry Records

Conditions Usually Found.—Poultry records are kept on comparatively few farms. This makes it impossible for farmers to determine the efficiency of their flocks or their feeding methods. Records are more frequently kept on commercial poultry farms.

Aims.—Students should learn what records are necessary, and develop skill in keeping and analyzing such records. (Besides the special poultry forms given here see those suggested in beef enterprise.)

Problems for Study and Discussion.—(1) Why do so few farmers keep records on their poultry flocks? What are the results of such a condition? Find what local farmers keep poultry records. How many do not?

2. What is the relation between income from egg production and feed cost per hen? What data are necessary in order to determine this?
3. How do you find the labor income from a poultry enterprise?
4. How does the overhead affect the labor income?
5. How does the size of flock affect labor income?
6. What records are needed in order to determine the cost of producing pullets?
7. What proportion of the receipts in the poultry enterprise comes from eggs? From live poultry? How does breed affect this?
8. What facts should the analysis of a poultry record reveal?

Activities.—(1) Secure the summaries of a number of poultry demonstration flock records either from your county extension agent or elsewhere, and make as complete an analysis of these records as possible. (2) Compare these with the standards for your state as set up by your poultry specialist. (3) Write to your state agricultural experiment station for recommended account forms for keeping records of egg, feed, incubator, and brooder.

Importance of Keeping Records.—A short time ago the author had occasion to examine the production records of a number of farm poultry flocks. The lowest average cost of producing eggs per dozen on any farm was 20 cents. The highest cost was 75 cents. Here is a difference of 55 cents in the cost of producing eggs on two farms. What was the cause for this difference? In order for a hen to be profitable she must lay a large number of eggs in a year. High egg production depends upon (1) the inherited ability to lay eggs, (2) the capacity to consume a large amount of feed above that needed for maintenance, and (3) the health and vigor required to maintain production over a long period of time.

Because of the fact that hens possess these qualities in varying degrees, we find a wide variation in their annual egg production. This means a corresponding variation in profit because poultry records show that where the egg production is high the cost of production is usually low, and vice versa.

It follows that the highest producing hens are the most profitable. The same is true of flocks. This explains the main reason why the production costs on some farms are high while others are low.

There are many factors which affect the cost of producing eggs, such as (1) the production per hen, (2) feed costs, (3) mortality, (4) labor efficiency. Prices of eggs also affect the profits. A frequent detailed analysis of these factors is needed in order to make the adjustments in flock management necessary to keep the production costs as low as possible. A system of records and accounts is essential, in order to supply the data needed for this analysis. Records accurately kept and studied are the basis for efficient management.

Kinds of Records to Keep.—Because of the varying conditions on farms, it is necessary for the poultryman to keep such records as will enable him to study his business. The kinds of records needed will depend somewhat upon the nature of the poultry enterprise. Where eggs are produced for market, the egg and feed records are essential. Where pullets are raised, incubation and brooding records should be kept.

Keeping the Egg Record—No poultry enterprise, whatever its size, should be without a daily egg record. Such a record shows any variation in production due to weather, feeding, housing, and care. By watching the daily egg record the poultryman may make the needed adjustments in his management program. A simple egg record may be made by taking a sheet of heavy paper of convenient size and ruling both ways. Write the names of the months in the columns at the top, and the days of the month between the horizontal lines at the left. Fasten this sheet and a pencil to the inside wall of the poultry house at a place most convenient for the attendant to make the daily record.

Keeping a Flock Record.—This record is more complete than the egg record, and furnishes data for a more detailed analysis of the poultry business. It includes a daily egg record; amount and price of feed used;

RECORD OF THE FARM POULTRY FLOCK

Name.................................Breed of Chickens.................................

Address........................County....................................Month of....................19......

EGGS GATHERED		EGGS AND POULTRY SOLD OR EATEN			EXPENSES					
Day of Month	Quantity	Item sold (Give price per dozen, pound, or head)	Cash Received		Feed—From farm or purchased (Item and price per pound)	Cost		Other expenses (Stock, equipment, etc.)	Cost	
			Dollars	Cents		Dollars	Cents		Dollars	Cents
1										
2										
3										
31										
		Home use—No. doz. eggs..								
		Home use—Chickens......								
Total for Month										

Number hens died..........Number hens beginning of month............Number hens at end of month............

Totals Below to be Filled in by Coöperator

Total receipts for month....			Total expenses for month...			Cash gain or loss for month.		
Previous total receipts.....			Previous total expense......			Previous cash gain or loss...		
Total receipts to date....			Total expense to date....			Cash gain or loss to date..		

Average No. eggs per hen for month......Previous Average No. eggs per hen......Average No. eggs per hen to date......

(The average number eggs to date is found by adding average per month plus previous average) number and price of eggs sold, used on the table, and used for setting; amount and price of live poultry sold and used on the table; and other expenses. It also includes an inventory at beginning and end of the year.

A very satisfactory form for such a record is here given. It is used by poultry demonstration flock owners.

Incubation and Brooding Record.—If chicks are hatched, a record should be kept of each hatch. It should include the number of eggs set, daily temperature, number of infertile eggs, number of dead germs, number of strong and weak chicks hatched. This gives a check on the fertility and hatching qualities of the eggs of the flock for different periods during the hatching season.

A brooder record should also be kept. It should include a record of the number of chicks placed under the hover, the mortality each day, amount of feed and fuel used, and the number of birds sold.

What the Analysis Should Show.—As was suggested under the discussion of culling, it is essential for the poultry-keeper to have a standard or measuring device to use in checking the efficiency of his flock. The table shows the monthly production of an individual farm flock as compared with the 160–egg standard, the 1925 average of 461 demonstration flocks, and the ten highest and ten lowest demonstration flock records.

Monthly Egg Production per Hen

Month	Individual flock	160 egg standard	Average 461 flocks 1925	Ten high flocks	Ten low flocks
November	6.4	5	4.9	16.7	.3
December	5.8	8	6.2	19.9	1.4
January	6.7	10	7.6	17.8	6.8
February	11.5	13	9.8	16.0	12.4
March	12.1	16	15.6	21.2	10.4
April	27.3	20	18.4	23.3	10.0
May	23.0	21	18.5	22.3	9.7
June	21.1	18	15.0	19.5	7.9
July	21.7	17	14.9	19.0	6.3
August	19.1	14	13.0	16.4	6.5
September	10.7	11	10.5	14.7	2.3
October	3.8	7	5.9	6.6	.7
Total	174.2	160	140.3	213.4	74.7

Points Shown.—An analysis of the above table shows the following points:

1. The average annual production per hen for the individual flock is 14.2 eggs above the state standard, 33.9 eggs above the average of 461 demonstration flocks, but 39.1 below the ten highest.

2. The average winter production (for Nov., Dec., Jan., Feb.) is

30.4 eggs. This is 5.6 eggs below the state standard and only 1.9 above the average for 461 flocks. Compare this with 70.4 for the ten highest flocks. It should be remembered prices are highest in winter and that high winter production is necessary for a high yearly flock average.

3. The average summer production (for July, August, September and October) is 55.3 eggs. This is 6.3 above the state standard and 11 above the average for 461 flocks. This is only 1.4 below the ten highest.

The low winter egg record of this individual flock is due largely to a large number of poor layers. The flock was culled late in March from 235 down to 120 hens and the average production per hen increased immediately and persisted until October, when remodeling the poultry house disturbed the hens and curtailed production.

The next table gives a summary of the cost of producing eggs for this individual flock in comparison with the 461 poultry demonstration flocks.

Summary of Cost of Producing Eggs

Item	Individual flock	Av. of 461 flocks—1925
Av. number of hens per year	162	242
Cash receipts per hen (eggs and live poultry)	$6.21	$5.85
Feed cost per hen (including cost of rearing young)	2.56	2.65
Cash returns per hen above feed cost	3.65	3.20
Labor income per hen	2.28	2.69
Feed cost per dozen of eggs	.18	.22

Points Shown.—An analysis of the above table shows that the feed cost per hen was 9 cents below the average for 461 farms, and the feed cost per dozen of eggs was 4 cents below.

The cash receipts per hen and the cash returns above feed cost were above the average for 461 flocks, but the labor income was somewhat lower.

If an accurate system of records is kept, the poultryman is able to determine the following points:

1. Labor income from the poultry business. The labor income may be defined as what the operator receives for his year's work above all expenses and interest on capital invested.

2. The feed cost per dozen of eggs produced during any month or season of the year.

3. The percentage of egg production during any month or season of the year.

4. The cost of rearing pullets.

Job 11. Exhibiting and Judging Poultry

Conditions Usually Found.—(1) A poultry exhibit is an annual event in a large number of rural communities. (2) These exhibits are frequently held on a county- and state-wide basis. (3) In a similar way, poultry-judging contests have been developed.

Aims.—Judging poultry and methods of conducting poultry shows should be understood.

Problems for Study and Discussion.—(1) What is the nature of the poultry shows held in your community? In your county? In your state?

2. How many poultry keepers in your community exhibit eggs or birds at these shows or fairs?
3. What educational results should come from poultry exhibits?
4. Outline the procedure to be followed in running a poultry show.
5. What should be the nature of prizes offered? How should these be secured?
6. What is the basis for selecting birds for exhibition? How should they be prepared?
7. Should birds be judged for production value only or for breed characteristics, or both? Why?
8. How does judging poultry differ from judging other farm animals?
9. What results should be derived from poultry judging contests (local, county and state) as they are being conducted?

Activities.—(1) Practise washing and cleaning birds for show. (2) Train birds for handling at a fair. (3) Select trios, singles, and pens to conform with the offerings in a fair premium list. (4) Practise judging poultry at a show, with and without a score card. (5) Assist in holding a poultry show.

Value of Poultry Shows.—There are many different kinds of poultry exhibitions held annually throughout this country. Examples are separate community poultry shows conducted by a local poultry organization; poultry exhibits at community or school fairs; separate county and state poultry shows; exhibits at county and state fairs; and state and national egg-laying contests. All these efforts are commendable, but the small local show confined to exhibits of a single community offers the greatest educational possibilities. It is here that the poultry keepers come together and bring their products, and are able to compare the results of their work each with the other. This personal touch creates interest in the production of a better quality of poultry and this interest soon spreads throughout the community.

This community interest is not found in such larger exhibits as the state poultry shows or fairs. As a result, money from prizes has become the chief objective. The educational value should always be made the controlling purpose of the local show and everything should be planned to achieve that purpose. Many poultrymen have even doubted the value of poultry shows, regarding them as sport for the poultry fanciers. This has come about through undue emphasis upon color patterns and breed characters. More emphasis in local shows should be given to utility features, such as production and egg classes.

Methods of Conducting the Show.—Carefully laid plans are necessary to insure a successful poultry show. These plans must be laid well in advance of the show. They should include the following activities:

1. Drawing up the rules and the entry lists.
2. Securing a suitable room and the equipment necessary to handle the exhibits.
3. Securing a competent judge.
4. Preparing and disseminating the publicity material in the form of newspaper articles, posters and other effective advertising material.
5. Securing necessary prizes or awards.

Where the classes in Vocational Agriculture conduct the show, it is well to appoint committees and allow each committee to assume responsibility for one of the above activities. For example, the first committee should draw up the rules, entry lists and entry forms and properly enter the exhibits on the opening of the show.

This division of labor should be worked out in detail in order that everything will run smoothly during the show. For more specific information about drawing rules and entry lists, write to the poultry department at your state college of agriculture.

Selecting and Preparing Birds for Exhibition.—When selecting birds for exhibition, each student should have access to the *Standard of Perfection*. This gives a complete description of the shape and color of each breed and variety for both males and females. It also gives the standard weights and disqualifications. The following general rules may apply in selecting birds:

1. Birds should come up to or a little above the standard weight.
2. Birds should be free from any blemish or disqualification.
3. Birds should conform as nearly as possible to standard in shape of body and color pattern.

Washing.—The exhibitor should send his birds to the show absolutely clean. The comb, wattles, ear lobes, the shanks and toes should be washed with warm water and a brush to remove dirt. After they are clean, they should be sponged with cold water and rubbed dry with a soft cloth.

It may be advisable to wash white-plumaged birds before exhibiting them. This is a rather difficult process and should be done with extreme care. To do this efficiently three tubs should be provided and filled with clean, soft water. The temperature of the water in tub No. 1 should be about ninety degrees; in tub No. 2 lukewarm; and in tub No. 3 the ordinary room temperature. Dissolve a cake of Ivory soap in tub No. 1 and form a good suds. Submerge the whole bird except the head in tub

No. 1 and sponge the plumage thoroughly until all dirt is removed. When the bird is thoroughly clean, transfer to tub No. 2, submerging and withdrawing, permitting the water to rinse all the suds from the plumage. Then dip the bird in tub No. 3 for an additional rinsing. Provide the room temperature around eighty degrees so that the bird will not catch cold. If left alone the birds will dress their own plumage when partially dry. The coops should be provided with clean litter in order to keep the birds clean until the time of the show.

Methods of Judging.—Two distinct methods of judging fowls have been used in the past, the score-card and the comparative method. Poultry is the only class of farm animal where the score card is used in placing awards. This is rather a slow process and the comparative method is more commonly used at present. (Fig. 228).

Fig. 228.—Students studying egg-type characteristics in poultry at the high school, Michigan.

In comparative judging, the entries should be so arranged that the fowls of a class are adjacent to one another. One should first pass along the front of the cages and eliminate the poor exhibits and then work over the best fowls in detail until sure of the relative rank of each. In addition to a knowledge of the standard for each breed and variety, this method of judging demands very careful observation.

Disqualifications in Judging Poultry.—There are many things which disqualify poultry, such as feathers on the legs of smooth-legged breeds or smooth legs when feathers should occur; irregular color of legs or plumage; incorrect position of the comb and many other things. A complete list of disqualifications for the different breeds and varieties may be found in the *Standard of Perfection*.

Judging Fowls for Utility.—During recent years much attention has been given to judging fowls on the basis of utility. In these classes the birds are shown at the height of egg production. This is not the case with ordinary exhibition birds, for they are shown just prior to the period of production when their plumage is finest. In the utility classes less consideration is given to plumage and more consideration to body form and evidence of egg production.

Several score cards have been drawn up for utility judging. The following score card is used in the Ohio State Judging Contest and was drawn up by E. L. Dakan, of Ohio State University. (Figs. 229 and 230).

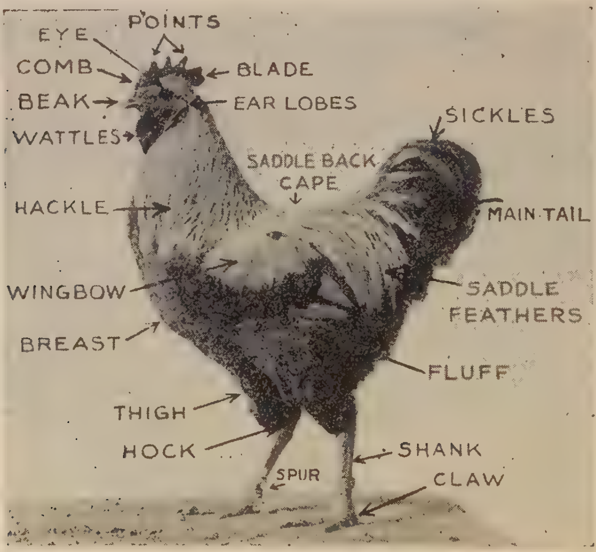

Fig. 229.—Illustration showing names of parts of a fowl.

Points to be Considered in Judging Poultry.

I. Body type (as seen in coop or on floor).

Good characteristics.	Poor characteristics.
Deep breast.	Short back.
Long level back.	High shoulders.
Deep abdomen.	Shallow breast.
Straight underline.	Shallow abdomen.
Broad body.	Tapering underline.
Tight feathering.	Narrow body.
Rectangular appearance.	Loose feathered.
	Round in appearance.

II. Head and adjuncts.

Good characteristics.	Poor characteristics.
Lean face.	Short and too deep.
Large comb.	Too long and shallow.
Bright red color.	Puffy or coarse face.
Large oval eyes.	Small comb.
Prominent eye.	Pale or purplish comb.
Medium well-curved beak.	Small round eye.
Moderately broad and deep.	Sunken eye.
	Long sharp beak.
	Beak yellow.

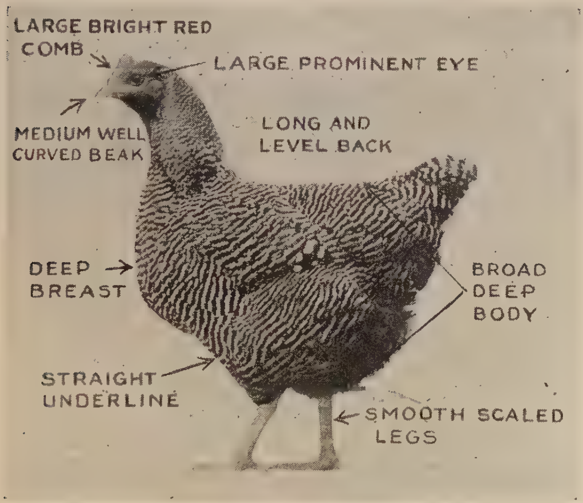

Fig. 230.—The characteristics of a good hen.

III. Body conformation (as determined by handling).

Good.	Poor.
Long keel.	Short keel.
Deep broad body.	Shallow narrow body.
Large full abdomen.	Small abdomen.
	Short, narrow, tapering back.

IV. Handling quality.

Good.	Poor.
Loose, thin and mellow skin.	Light, thick, coarse skin.
Pliable and soft abdomen.	Light and hard abdomen.
Thin, pliable pelvic bones.	Thick, stiff pelvic bones.

V. Legs and toes.

Good.	Poor.
Bleached-out shanks.	Yellow shanks.
Flat, pliable, and smooth-scaled legs.	Round, rough legs.
Short, blunt, smooth toenails.	Long, pointed toenails.

VI. Condition.

By condition is meant ability both to withstand and to produce the high egg production sought for in domestic fowls. This is shown by:

Good health, vigor, and vitality.
Surplus fat.

VII. Laying or not laying.

(In judging hens the question of whether or not they are laying is an important point to be considered, especially during the latter part of the summer. The following characteristics of layers and non-layers must be considered in connection with the six points mentioned above. For instance, the non-laying hen will rank low in body conformation because the abdomen is narrow and cramped.)

Laying.

Vent is large, dilated, oblong, and moist.
Pelvic bones are flexible and wide apart.
Comb is large, red, full, and glossy.
Wattles and lobes are prominent, soft, and smooth.
Keel slopes downward.
Pelvic bones point straight out and have thin tips.
Abdominal capacity of four to five fingers.
Abdomen soft, pliable, dilated.
Rump broad, with width carried back.
Lateral processes prominent and pointing outward.
Skin soft, loose, silky.

Not laying.

Vent is small, contracted, round, and dry.
Pelvic bones are rigid and close together.
Comb is small, pale, and scaly.
Wattles and lobes are inconspicuous, rough, and dry.
Keel slopes upward.
Pelvic bones curve in and tips are thick.
Abdominal capacity of two fingers or less.
Abdomen narrow and cramped.
Lateral processes are hard to find and pointed inward.
Skin thick, dry, underlaid with fat.
New smooth plumage.
Slow, early molting.

Job 12. Marketing Poultry Products

Conditions Usually Found.—(1) The quality of eggs produced on the average farm is very low. (2) During the warm season, many spoil before reaching the consumer's table. This loss is due largely to improper handling on the farm. (3) Most of the eggs marketed at country points are ungraded. (4) Some cities have developed a demand for a high-quality product. This makes the grading of eggs profitable. (5) Coöperative marketing of poultry products is growing rapidly.

Aims.—Students should learn (1) how to prepare for market poultry products of high quality, and (2) the most efficient methods of marketing them.

Problems for Study and Discussion.—(1) In what different ways are eggs marketed in your neighborhood? How many of the farmers grade their eggs?

2. How do you account for the large gap between farm prices and egg-market quotations?
3. What factors affect the interior quality of eggs? How can deterioration in quality be prevented during warm weather?
4. What are the advantages of selling eggs on the basis of grade? What are the common market grades?
5. What possibilities does shipping direct offer to the average farmer? How would you proceed to locate a commission man?
6. What variation do you find in the market demands of the various cities?
7. How should eggs be packed for shipment?
8. How do storage eggs affect the market price of eggs in winter?
9. How does buying of eggs for cold storage affect summer prices?
10. How does coöperative marketing of eggs differ from the older methods? How does this affect the quality of eggs produced?
11. How is the pool price of eggs determined? What is the length of the pooling period?

Activities.—(1) If possible visit an egg-grading station and observe how eggs are graded and packed for market. (2) Practise grading eggs for market from home. (3) Obtain one or more crates of eggs, just as they have been assembled by the huckster or local grocer. Grade them according to market standards. (4) Plot a curve showing egg prices over a period of several months. Along beside this plot a curve of a five- or ten-year average for the same months. This will serve to show the relation of present prices to the normal for each season of the year.

Preserving the Quality of Eggs.—"The poultryman has a peculiar advantage, as compared with the producer of milk, for example, in that the hen delivers her product in such convenient form. She gives him the semi-fluid, edible portion of the egg, in a convenient size for table use, in a special sealed package, wrapped with two membranes and sealed within the shell. All the skill, expense, hazard and thought given to the enterprise culminate in the production of the egg. The aim, therefore, should be to preserve the quality of the finished product and thereby secure the proper price."—Rice and Botsford, *Practical Poultry Management*, page 223.

More than half of our total egg production comes in April, May, June, and July. On the other hand, the monthly consumption of eggs is fairly uniform throughout the year. This means that some time must elapse before many of the eggs will reach the table of the consumer. During the season of heavy production, the surplus eggs must be preserved until the season of low production by means of refrigeration.

Frequently the producers and consumers are widely separated and the eggs must be shipped long distances which also requires time.

The producer's problem is to handle the eggs in such a way as to avoid conditions conducive to their deterioration during the time that must elapse between production and consumption.

Gathering and Keeping Market Eggs.—The internal content of an egg when laid by a normal hen is usually free from bacteria, but it frequently becomes infected through improper handling. When eggs become dirty, bacteria adhere to the shell and under favorable conditions may pass through the pores of the shell, find their way through the membranes, and enter the contents of the egg. This causes the eggs to deteriorate in quality and even mold or rot.

Eggs will rarely become infected if they are kept perfectly clean and dry because the shell of a new-laid egg is covered with a "bloom" which protects it against the entrance of bacteria. The presence of moisture dissolves off the bloom, opens up the pores of the shell, and destroys this protection. Moisture is also a favorable medium for the growth of bacteria.

The eggs should be kept dry and clean. To this end, the nests and litter must be kept clean and the hens must be kept in the house during rainy, muddy weather.

High temperature is another cause of deterioration, especially in fertile eggs. The embryo begins to develop at a temperature of 68 degrees F. Where broody hens are allowed to remain on the nest or where, because of insufficient nests, laying hens keep the eggs covered continuously, the eggs may be held at a temperature of about 100 degrees throughout the day. This will start incubation in a fertile egg and result in having market eggs of low quality.

Good Market Eggs

1. Gather frequently, at least daily.
2. Coop up broody hens.
3. Provide plenty of clean nests.
4. Produce infertile eggs.
5. Store in cool, ventilated cellar.
6. Scrape dirty eggs, never wash.
7. Grade eggs carefully.
8. Pack to suit market.

Grading Market Eggs.—Eggs produced on the average farm are commonly sold without grading. Where no premium is placed on quality, it is usually unprofitable for the poultry-keeper to grade them. Where eggs are sold on a quality basis they are graded on the following qualities:

Exterior Quality.

Size, 24-oz. dozen, uniform.
Color, uniform, white or brown.
Shape uniform.
Shells sound, strong, clean.

Interior Qualities.

Contents clear when candled.
No dark spots or blood rings.
Air cell small.
Yolk outline very faint.

Eggs are usually classified as fresh-gathered, storage-packed, refrigerator, and processed. The market grades are usually extras, firsts, seconds, and dirties.

If eggs are to be shipped, they should be well packed in a clean standard 30-doz. case, with the large end of the egg up.

Marketing Services.—Marketing was a comparatively simple problem in the pioneer days when each producer found a market for all his surplus poultry products in the neighboring village. The producer performed all the marketing services necessary to get these products from his farm to the consumer.

Today producers and consumers are often widely separated. Surplus poultry products produced on farms scattered all over this country must be assembled and transported to where they are needed and at a time when they are needed for consumption. In order to do this, a large number of marketing services must be performed. The people performing these services may be middlemen or coöperative associations. The following is a list of these services:

1. *Assembling.*—Almost every farm in a community produces a few dozen eggs to sell. These eggs must be collected or assembled in order that they may be shipped economically to distant markets. This is usually done at country points by hucksters or grocers.

2. *Grading and Packing.*—The eggs assembled from the farms are ungraded. The produce dealer usually candles, grades, and packs the eggs before shipping.

3. *Shipping.*—Transportation companies, such as railroads and truckers, transport these products from where they are produced in surplus to where they are needed for consumption. Eggs are being continuously shipped across the continent for consumption.

4. *Storing and Financing.*—Approximately two-thirds of the total egg production comes in the spring and early summer. The consumption is fairly

constant throughout the year. The surplus eggs at this time must be stored. Large storage companies make a special business of storing eggs. Money is also needed with which to buy and hold these eggs until the consumer is ready to buy them.

5. *Retailing.*—Eggs are usually sold in the cities through groceries and produce stores.

Our marketing system at present is composed of business enterprises organized for the purpose of performing one or more of these services.

Coöperative Marketing.—Farmers have become very active in setting up business organizations to perform some of these marketing services. Through their organizations, eggs are assembled at local grading stations, where they are graded, packed, and shipped to large markets. This enables the farmer through his organization to get his products nearer the organized market, a thing which he could not do individually. One of the most important results of marketing eggs coöperatively is in placing a premium on quality. Eggs are graded and the pool price is determined on the basis of grade. This has stimulated farmers to produce eggs of higher quality.

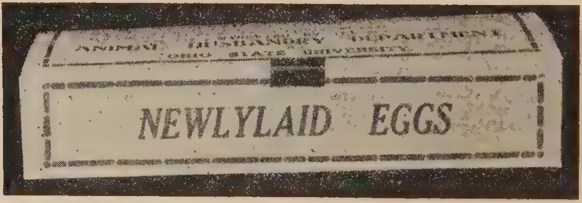

FIG. 231.—Marketing high-quality eggs. An attractive egg carton, one-dozen size, for use in marketing eggs locally to a special trade.

Coöperative marketing of poultry products really began with the egg circle, where a few people in the community agreed to ship their eggs direct to a commission firm in some central market or to consumers. A large number of egg circles are in existence over the country.

Marketing Direct.—During the winter months many poultrymen have found it profitable to ship direct to an eastern market. This is especially true where it is not possible to ship through a coöperative association. When shipped direct, the eggs must be carefully graded and packed. The reliability of the commission firm handling the eggs should be thoroughly investigated. Poultrymen living near a large city frequently find special markets, such as chain stores, hotels, and restaurants. This type of market usually demands that the eggs be fresh, of high quality, and carefully graded. They are usually packed in one-dozen cartons which are convenient for handling. (Fig. 231).

Market Prices.—The farm price of eggs at any place, or at any time, is determined largely by the supply of eggs. Prices are always higher near New York City, which is the center of a large deficit area, than they are in Illinois, which is the center of a large surplus area. (Fig. 232). There is a free movement of products from one section to another, thus preventing a marked difference in price.

Seasonal production also affects the price. As stated, two-thirds of our total egg production comes in April, May, June and July, or in a third of the calender year. What happens to the price? It naturally declines, as we might expect. When the price begins to decline, eggs move into storage because the storage men know that there will be a shortage of eggs later on. Were it not for storage, it would be almost impossible to sell eggs at one season of the year, and they would be exceedingly high at another.

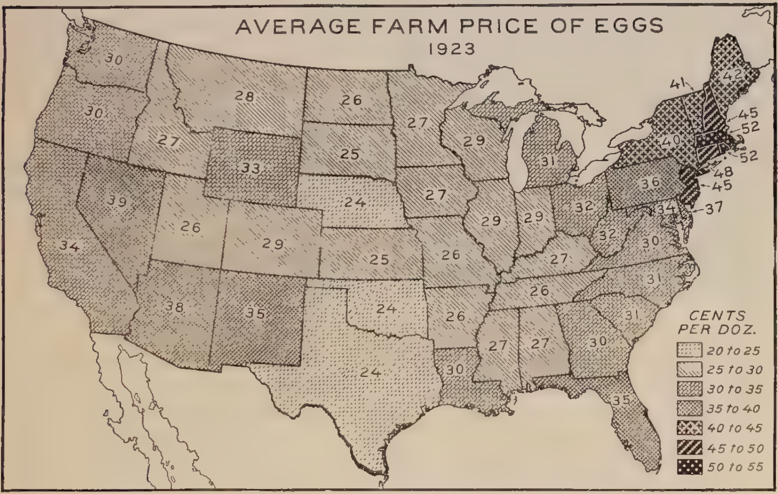

FIG. 232.—Average farm price of eggs.

Returns from the poultry business depend upon (1) low cost of production, (2) producing winter eggs when fresh-egg prices are high, (3) producing eggs of good quality, and (4) marketing to best advantage.

Kinds of Poultry to Market.—The market condition of the live poultry has just as much bearing on the price received as does the market quality of eggs. In the course of a year, the poultry farmer usually has available for market: (1) two-year-old hens; (2) cull pullets and hens; and (3) broilers, consisting of cockerels and cull pullets from the young stock. His problem is how to sell them at a time and in the condition which will bring the greatest returns.

Fattening Birds for Market.—Birds must be fat to be in good market condition. This is accomplished in two ways:

1. *By Pen Fattening.*—This is the method most commonly followed. It consists of placing 20 to 30 birds in a pen, allowing about two square feet per bird. This restricts exercise and requires a minimum amount of labor.

2. *By Crate Fattening.*—(Fig. 233). This method is used at large commercial fattening stations. Crates 6 to 8 feet long, 2 to 3 feet wide, and 1½ feet high, are used. The crates are slatted and feeding troughs are arranged around the outside. Crate fattening produces a flesh of high quality.

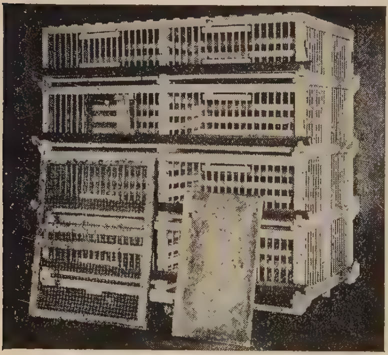

FIG. 233.—A portable battery of feeding coops, used in commercial crate fattening. The weighing, feeding, and moving of the birds can be done without taking them from the coops. (Photo by U. S. Bureau of Chemistry.)

Birds are usually fed about one to two weeks. Cornmeal and milk are the main feeds used. Corn appears to put the fat in layers beneath the skin, and milk, between the muscle fibers. This combination gives a mild flavor and a tender, juicy meat, known as milk-fed poultry.

The Cornell ration is as follows:

50 lbs. cornmeal.
20 lbs. wheat middlings.
10 lbs. ground heavy oats.
Mix with skim-milk or buttermilk at each feeding.
Use 1 qt. of milk to 1 qt. of feed.
Feed twice daily all the birds will eat.

Producing Capons.—A capon is a male bird with the reproductive glands removed. Caponizing a chicken is analogous to castrating a boar or a ram and is usually done just after the sex organs begin to develop.

Rather heavy breeds make the best capons. Rhode Island Reds, Plymouth Rocks, and Wyandottes are usually ready for caponizing at two months of age when the cockerels weigh about 24 ounces.

The operation consists of removing the glands by cutting into the body cavity between the last two ribs three-fourths inch below the backbone. The glands are then quickly removed with special instruments. Birds are starved a day in advance. Caponizing produces a marked change in the development of the bird. The capon does not crow but clucks and sings like a hen and can be trained to mother a brood of chicks.

The growth of the comb and wattles practically ceases. The bird becomes very quiet and stands confinement well. Capons are easily fattened and produce a flesh of high quality.

The production of capons is not profitable except where comparatively high prices are received on a special market.

Dressing Poultry.—Most poultry raised under farm conditions is marketed alive. This takes less time and requires less equipment. Some markets, however, require the poultry to be dressed.

Birds to be dressed should be kept without feed for 24 hours before killing in order to empty the crop and intestines. They are bled by sticking in the mouth. Where dry-picking is practised, the brain is pierced immediately afterward in order to loosen up the feathers. Birds will usually keep better when dry-picked, although scalding is sometimes practised. The carcasses should be cooled and packed for shipment. Drawing and deboning are sometimes practised.

Marketing Live Poultry.—The assembling of live poultry at country points is very similar to the assembling of eggs. It is usually done by hucksters and by coöperative associations maintaining fattening stations where the poultry is fed before shipping to market. A few poultrymen secure crates from commission men and ship direct. As in the case of eggs, buying on a quality basis has stimulated farmers to get their live poultry in better market condition.

Things to Make.—Sun-parlor for brooder; trap nests; hoppers for grit and for feed; nest batteries; water fountains; water stands; movable houses; small unit houses; brooder houses; brooders; feed troughs; feed platforms; catching coops; show coops; shipping crates; carrying crates; egg crates.

Reference Books.—Benjamin, Marketing Poultry Products, (Wiley); Dryden, Poultry Breeding and Management, (Judd); Jackson and Curtis, Poultry Culling and Selection Flock Breeding, (Rel. Poul. Jl., Dayton); Kaupp, Poultry Diseases, (Saunders); Lewis, Productive Poultry Husbandry, (Lippincott); Lippincott, Poultry Production, (Lea-Febiger); Pearl, Surface, and Curtis, Diseases of Poultry, (Macmillan); Rice and Botsford, Practical Poultry Management, (Wiley); American Standard of Perfection, (Am. Poul. Assn., Ft. Wayne); High Egg Production, (Rel. Poul. Jl., Dayton).

Bulletins and Pamphlets.—Cornell Reading Course, Lesson 156, Incubation; Cornell Ext. Bul. 113, Pedigree Hatching and Record Keeping. Ohio Station Bi-Monthly Bul. Jan. 1926, All-Mash Feeding. Penn. Station, Ext. Cir. 87, Culling the Flock. Wis. Station Bul. 371, Chick Feeding. U. S. Yearbook (1924) Separate 917, Poultry Industry. U. S. Bu. Agrl. Economics, Agricultural Situation (Monthly). Secure all bulletins from your State Agricultural Experiment Station.

BEE ENTERPRISE

By Kary C. Davis, Ph.D.

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Revised by Mrs. Armstrong Allen, Instructor in Beekeeping, Peabody College.

Analysis Into Jobs.—The following jobs include the chief teaching units in a beekeeping enterprise. References are to numbers of U. S. Farmers' Bulletins. See also books by Pellett and by Phillips.

1. Determining possibilities with bees. Bul. 447, 1215, 1216, 1222.
2. Getting started in the business. Bul. 961.
3. Caring for the apiary. Bul. 447, 1012, 1014, 1198.
4. Controlling diseases and enemies. Bul. 975, 1084.
5. Marketing the products. Bul. 1039.

Job 1. Determining Possibilities with Bees

Conditions Usually Found.—(1) In a few parts of the country, beekeeping is a special industry—men and women giving their entire time to the business. (2) Much of the honey of the country is produced as a side line to other farming.

Aims.—Students should study the expenses, possible losses, labor and capital requirements, prices to be received, and other factors before deciding to keep bees.

Problems for Study and Discussion.—(1) Talk with local beekeepers regarding the outlook for this industry.

2. Ask them regarding the cost of hives and the amount of time and labor in caring for bees.
3. Find what prices are received for comb honey and for extracted honey.
4. Find what diseases have been serious in apiaries.
5. What is the average yield of honey per colony?
6. What experience and knowledge are necessary before keeping bees?
7. What fruit do you grow that would be benefited by the presence of bees?
8. What are the chief bee-pasture plants of your region, and how abundant?

Activities.—(1) Send for catalogs of bee hives and other equipment. (2) Make a chart showing the items of cost for the beekeeping business as given by a good beekeeper.

Liking the Business.—Before keeping bees, anyone should have some knowledge of the life and habits of bees and should naturally or otherwise learn to like the bees. Persons who are afraid of bees and who dislike to handle them or who are unusually susceptible to bad effects from stings should avoid this business.

Experience and knowledge are very important in starting a bee enterprise. Reading of good bulletins and books on bees will help prevent losses and add much to the interest and profit from bees. Experience obtained by working for other beekeepers will help the beginner to avoid many serious mistakes.

Suitable Location.—Bees must not be required to fly too far to find suitable honey pasture. Survey the region and make a list of the good honey-bearing plants within a short distance of your proposed bee yard. Sweet clover, white clover, alsike clover, locust and basswood trees, and many other plants which bear an abundance of nectar may be found or grown on large areas. The frequency of long drouths should be considered, as these seriously reduce the honey flow and may cause starvation of bees. Talk with other beekeepers regarding these points.

Labor Requirements.—Work with bees can be easily performed by girls, boys, women and men. Considerable time, however, is required. Rather constant attention is necessary during the most active season of the year.

Capital needed for the purchase of colonies and suitable equipment is usually less than for most farming enterprises.

Probable Income.—This enterprise is usually profitable under favorable conditions. Prices of honey are usually good. Extracted honey can be shipped to distant markets very readily. Comb honey is usually sold in local markets, which may be good or poor. Overproduction of honey is seldom a serious problem.

Diseases and enemies sometimes cause rather serious losses. Whole colonies are sometimes destroyed by foul brood disease. The best beekeepers are apparently unable to avoid losses from this source. However, under good management and prompt action they are able to check the losses. Sometimes animals and thieves cause heavy losses. Care and precaution may reduce these losses to almost nothing.

Benefits to fruit are often of enough importance to warrant the keeping of a few colonies of bees in the orchard or fruit garden. They aid in pollinating blossoms of apples, plums, peaches, clovers, alfalfa, and other plants.

Job 2. Getting Started in the Business

Conditions Usually Found.—(1) Italian bees are most commonly preferred. (2) Beginners usually keep only a few colonies.

Aims.—(1) Students should know the characteristics of good colonies of bees before buying them. (2) They should be able to distinguish between the different races of bees and choose the best.

Problems for Study and Discussion.—(1) Talk with local beekeepers regarding the different races of bees.

2. If possible try handling the black German bees and Italian bees before buying.
3. Describe the different races of bees.
4. Ask how experienced beekeepers started into the business.
5. How many colonies did each keep?
6. What points should be considered before buying a colony?
7. What should be the structure of the hive itself?
8. What are the marks of a strong hive in fall and spring?
9. Describe the moving of hives of bees.
10. What extra equipment is required for extracting honey?

Activities.—Make a chart showing the different races of bees with a column for advantages and another column for disadvantages for each race.

Things to Make.—(1) Put together hives which come knock down. (2) Make up sections or frames and put in foundation or starter. (3) Erect a one-room building for storage of supplies and for extracting honey.

Races of Bees.—The best race of bees should be vicious enough to keep away robbers and enemies, but they should be gentle enough to be easily handled by their owners. They should be industrious and produce much honey.

Italian bees are much more easily managed and are much more in use than any other race. They are good honey-makers, are gentle, and good in protecting themselves against robbers, diseases, and moths. They are easily recognized by yellow bands across the body behind the wings. There are usually three such bands.

German bees are sometimes called wild black bees. They are frequently found in domestication but are not nearly so common among beekeepers as the preceding race. They are very cross, easily excited, and easily overcome by diseases and moths.

Other races are Cyprian, Carniolan, Caucasian, and Syrian, all of which are more used in Europe than in America.

A complete colony includes three types of bees; one queen and a number of workers and drones. The workers secrete the wax, build comb, care for queen and larvæ, get pollen (Fig. 234), get nectar and ripen it into honey, defend and ventilate the hive, and do all work except egg laying. The queen lays all the eggs and is waited on by the workers who feed her. Drones are male bees, do no work, and have no stings. They are destroyed by the workers when the season of honey flow is over.

Buying Colonies.—The beginner should buy one or more strong colonies of bees. He should not be too ambitious to start with many hives. Buy from a reliable beekeeper about three good colonies with standard commercial hives. Each queen should be less than two years of age and the bees should be free from disease. Decide the strength of a colony by estimating the number of workers at night when they are practically all in the hive and not out at work. Be sure to locate the queen and have her and all the workers shut into the hive when it is to be moved (Fig. 237). The buyer should see that the frames are wired; and that the equipment is modern in every respect (Fig. 235). Ten-frame hives are usually standard in other measurements. Never buy hives that are not standard in size.

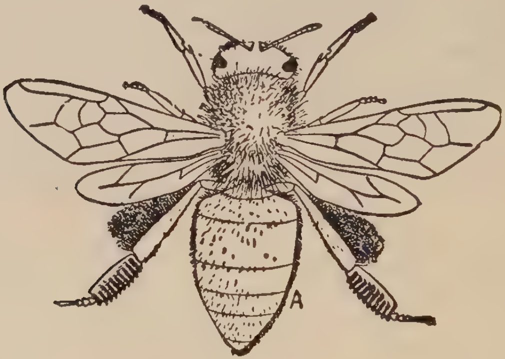
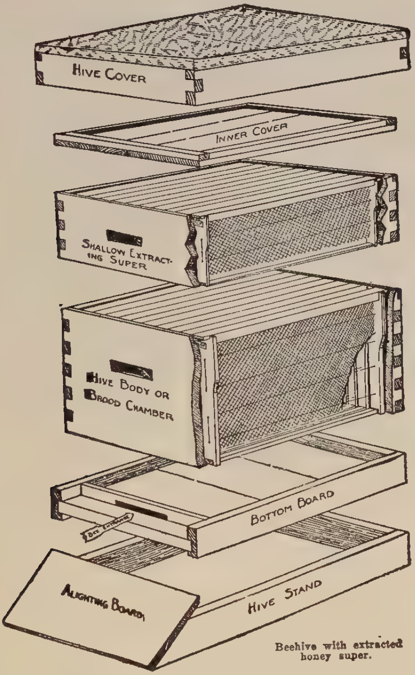


Fig. 234.—Note the load of pollen carried on the legs of a worker bee.

For handling bees provide a good veil, hive tool, a smoker, and a pair of gloves with gauntlets (Fig. 236). Each hive should have one or several supers to go above the brood chamber when the honey flow is good. The owner must provide additional hives in which to place new colonies when increase begins.

The bee yard should be located away from disturbances by other animals of the farm. It should not be too far from the residence, as close observation and attention are needed during the busy seasons. Easterly or southerly exposures are desirable. The hives should be raised a little from the ground. A small platform in front of each hive is advisable. Bees are often located in the fruit garden or orchard because of the work they will do in pollinating blossoms. A fence around the bee yard is usually advisable to keep out animals which might knock over the hives, and to keep out marauders. Provide the yard with running water or have the yard located where water may be supplied or secured easily. Bees drink much water in hot weather and at all times when brood rearing is active.

Moving Hives.—Bees are sometimes lost when the hive is moved. They locate their hive exactly and are disturbed by its being moved. A suitable time for moving a hive to a new yard is at night or on a rainy day when the bees are all in the hive. Close the mouth of the hive with a strip of wire netting tacked on. Fasten the parts of the hive together by nailing strips of lathe on all sides. Move the hive without serious jarring, hauling it in an easy-riding truck or automobile. Place it where it is to remain permanently, with a suitable board or platform in front. At night open the hive and let the bees become accustomed to their new surroundings and few, if any, will be lost. Moving should take place in the spring before warm weather begins. Provide screen tops for hives in hot weather.



Beehive with extracted honey super.

Fig. 235.—Parts of the hive.

Providing for Extracting.—The beginner should decide early whether he is to produce comb honey or extracted honey. When comb honey is to be produced, less equipment is necessary. If the combs are injured so they cannot be sold in sections, the owner may sell his product in the form of chunk honey.

A colony of bees will make many more pounds of extracted honey in a year because of not needing to rebuild their combs. The equipment for the extracting of honey is more expensive than the other equipment. Frames are to be uncapped and placed in a centrifugal machine for the throwing out or extracting of honey from the cells. The frames are replaced in the hives and the cells are refilled with honey by the colony.

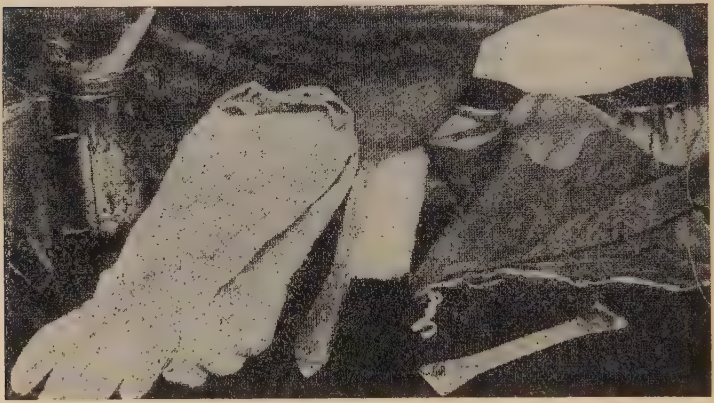


FIG. 236.—Important articles of equipment. Smoker, gloves, brush, veil, and hive tool. (Texas Station.)

Job 3. Caring for the Apiary

Conditions Usually Found.—(1) Beginners and those running a small bee yard as a side line are more apt to neglect the apiary than professional beekeepers. (2) Swarms are often lost in summer and colonies are often starved in early spring or in dry seasons by neglect.

Aims.—The best methods of caring for and handling bees should be learned by students.

Problems for Study and Discussion.—(1) What records should be kept by a bee owner regarding the condition of the hive in a colony?

2. Why should the hives be numbered?
3. Describe the inspecting of a hive to determine its condition.
4. What notes should be recorded in a record at this time?
5. Tell how to unite two weak colonies.
6. Describe the re-queening of a colony.
7. Describe how to feed bees that are in danger of starvation.
8. At what season should feeding be practised?

9. Describe how to handle and recover a swarm of bees.
10. In what ways may swarming be prevented?
11. Of what value is wing-clipping of queens?
12. When may a colony be divided? How?
13. What winter protection is needed in your locality? Give methods.

Activities.—(1) Draw forms for labor record, supply record and for sales of products. (2) Fill these forms with data in your own apiary or from a good beekeeper. (3) Build a fence for a colony yard. (4) Practise re-queening colonies. (5) Practise recovering swarms of bees. (6) Practise moving hives which must be moved. (7) Unite two weak colonies. (8) Divide a colony to prevent swarming.

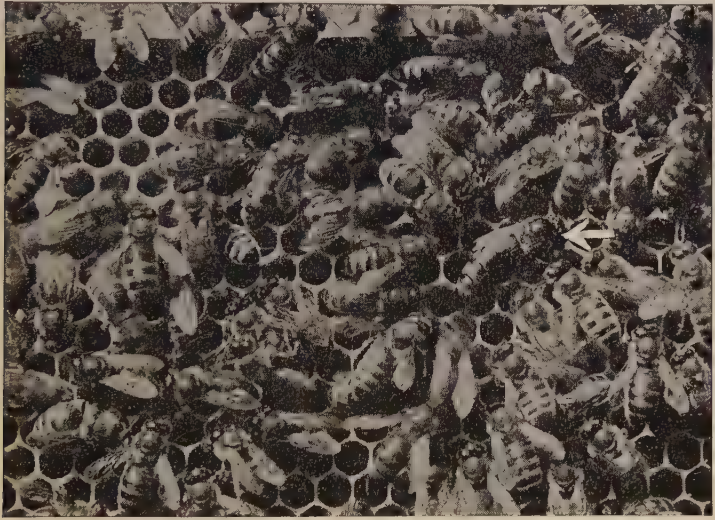


FIG. 237.—Part of brood section showing queen bee at the white arrow. She is laying eggs for newly made comb. She is recognized by her extra long body and by the circle of attendants facing her. (Pellett *Productive Beekeeping.*)

Examining Colonies.—It is good practice to examine a number of colonies and note the conditions in each. Learn to estimate the number of workers, detect unhealthy conditions, note the amount of brood, find the queen, (Fig. 237) locate queen cells, and estimate the supply of stores on hand. Decide when a new super is needed, whether re-queening is necessary, whether the colony is strong or weak, whether feeding will be necessary, whether dividing or uniting will be advisable, and whether robbing is going on. (Fig. 238).

Providing Pasture.—The beekeeper should either supply pasture by growing suitable crops on large enough areas, for other purposes, or should move the colonies to places where suitable pasture can be found. Ask local beekeepers what are the best local crops for bee pasture. In many regions the best plants are basswood, locust, fruit trees, white clover, alsike clover, sweet clover, goldenrod, dandelion, alfalfa, and aster.

Uniting Colonies.—Whenever colonies are found to be weak, as is sometimes the case in the spring after a hard winter, conditions may be improved by uniting weak colonies. Absence of brood during summer indicates no queen, and if there is no queen the colony will perish. If the queen is laying well and there are plenty of worker bees and plenty of honey, the hive will probably succeed.

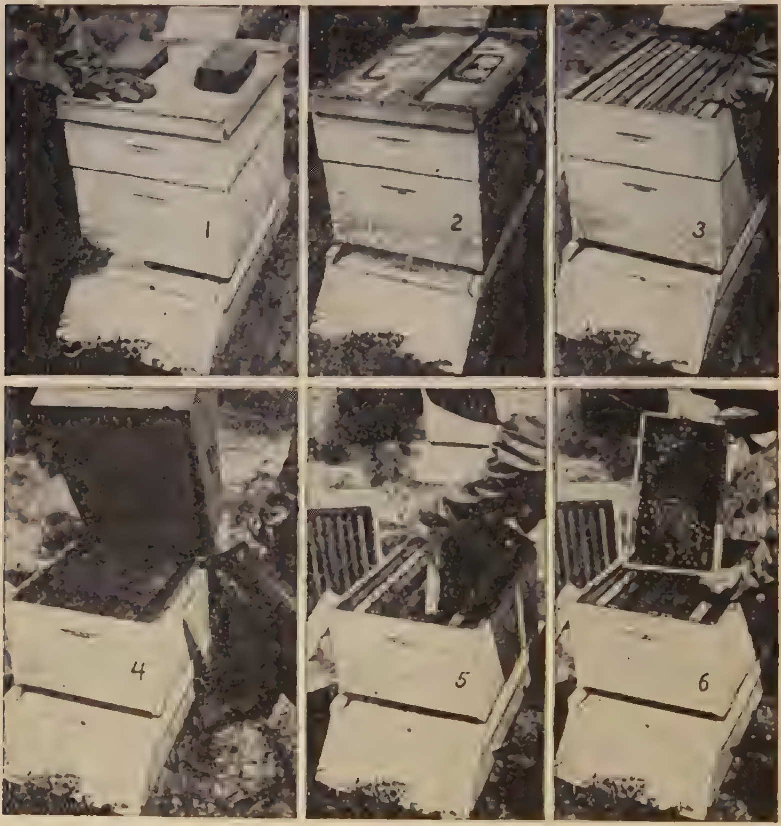


Fig. 238.—Inspecting a bee hive. 1, smoking the hive; 2, removing the top; 3, inspecting super; 4, removing the super; 5, removing brood frame; 6, inspecting brood. (Texas Station.)

To unite a weak or queenless colony with one having a queen, remove the top from the latter, place a layer of newspaper over it, and put the weak colony on top. The bees will soon eat openings through the paper and move to the lower brood chamber. A few days later the paper should be removed and the bees smoked down, so that the upper hive body may be removed. If honey remains in the upper frames, exchange them for the empty ones below.

Feeding Bees.—In the spring and sometimes at other seasons when the stores are about gone, the bees must be fed to save them from starvation. Beekeepers allow about thirty pounds of honey per colony in the fall and this should carry the bees through the winter safely. "Do the spring feeding in the fall" is a good maxim for beekeepers.

Mix two parts of white sugar with one part of water. Heat this to form a sirup. A pan containing the sirup may have a strip of cloth placed across it and reaching over the sides. This pan may be placed on the top brood frames with an empty super over it. Bees can thus get the sirup without being drowned. Another device is to use a friction-top can and punch a dozen small holes close together in the top. Place the sirup in the can and invert it over the brood combs.

Requeening.—If a colony is queenless but has plenty of worker bees and a good supply of stores, a new queen may be added. Get the best queen you can from a reputable breeder. Queens are shipped by mail in small cages. Do not attempt to introduce the new queen if another queen is in the hive. Place the mailing cage in the hive until the odor of the hive and the cage are the same. Workers will begin to use the sugar or candy in the cage and will become accustomed to the presence of the new queen. The cage may then be opened in the hive.

To introduce a queen from another hive, a good method is to keep the queen by herself for thirty or forty minutes in an empty cage. Then open the hive quietly, puff a little smoke between the frames, and let the queen run down. Examine the hive a few days later and see if the queen has begun laying eggs.

Swarming.—The desire to swarm is present in bees when they become overcrowded. The old queen goes out with the swarm, leaving several sealed queen cells in the hive from which a young queen can emerge later. Many workers and drones go with the swarm and may collect on a tree or other object near the hive. Have an empty hive ready and secure the queen and most of the bees and place them near the mouth of the entrance or directly in the hive. They will usually accept this as a new home. Close watching at the season when most of the swarming occurs will save the swarms. Carelessness at this time may result in losses of swarms.

Preventing Swarming.—To avoid over-crowding in the hive, the brood may be divided or given more room by placing another brood chamber over one that is nearly filled. Move a few frames of brood up into the new chamber. Always place the brood frames near the central part of the hive, leaving other frames for brood at the sides of each chamber. These frames should contain combs or full sheets of foundation. Whenever swarming time approaches, again divide or scatter the brood, placing empty frames between them. Bees will seldom swarm when they find they are not crowded. Supers may be added if desired to give new space. Some beekeepers cut out queen cells as another means of swarm prevention.

Wing Clipping.—Some beekeepers clip the wings of queens to prevent flying when the swarm issues from the hive. In this case the queen will usually be found on the ground near the entrance to the hive. She may be put in a queen cage or in an ordinary drinking glass and set in a new hive placed on the old stand. The old hive may be placed in a new location. The queen may be released in the new hive after the swarm of workers have gone into the new hive.

Dividing colonies is a plan often followed by good beekeepers to prevent natural swarming. When conditions seem to be about right for swarming to begin, remove the colony from its stand. Place a new hive containing combs or frames of foundation in its place. In the center of the brood chamber place frames containing brood from the old hive. Place the queen on one of these in the new hive. Be sure that new queen cells in these frames are cut out. Place a queen excluder over this new hive body and place the old hive above it. In a few days examine the upper story to see if there are any new queen cells present, and if so, this hive body should be removed to a new location. This may be done as soon as all larvæ cells have been capped. They will then need no more feeding. If no queen cells are found in the upper brood chamber, add a new queen to this colony or a rather mature queen cell. This plan is known as the Alexander plan of dividing a colony. It can be practised safely when honey flow is good and will supply the colonies well with nectar.

Dividing colonies by dividing the brood frames and seeing that a queen cell or a queen is left in each is commonly practised.

Job 4. Controlling Diseases and Enemies

Conditions Usually Found.—Foul brood disease, bee moths, and other enemies are often serious in bee yards.

Aims.—(1) Best methods of preventing these should be studied. (2) How to recognize these diseases and enemies should be known.

Problems for Study and Discussion.—(1) Ask local beekeepers what losses they have had from foul brood disease.

2. Examine hives where foul brood disease exists and learn to recognize it.
3. What signs in a hive indicate the presence of bee moths?

4. How can foul brood be prevented?
5. How can it be eradicated?
6. What treatments are recommended for bee moths?
7. What damage is done by robber bees?
8. How can robbing be controlled?
9. What beekeepers have experienced losses from bad boys or other honey thieves?

Activities.—(1) Renovate a hive which has been badly attacked by moths or disease. (2) Assist in eradicating foul brood from an apiary.

Foul Brood Disease.—Both the European and the American foul brood have caused serious losses to beekeepers. Both are very contagious. The American foul brood is the more serious. Both diseases are easily recognized by the appearance of the hive when bad cases have been once seen by the observer. Official bee inspectors require owners to clean up and prevent the spread of these diseases. Others having healthy bees near them should remove the hives to safe distances to prevent spread of the disease. Robber bees sometimes bring the disease from distant colonies. All bees of the region should be inspected by experts occasionally. All beekeepers should be warned when the disease first appears in any neighborhood.

Treatment consists in burning the hives and diseased parts when the first traces of the disease appear. Honey and comb from such hives should be buried to a great depth in the ground or should be consumed in a furnace. Healthy members of a colony may be transferred to a clean hive and the remainder covered with kerosene and burned. The inside of hive bodies and supers may be covered with kerosene and set on fire until enough heat is formed to kill the germs. Then the fire may be smothered and the boxes used again. Read U. S. Farmers' Bulletins 975 and 1084. European foul brood is treated differently. Follow the bulletin directions.

Bee moths seldom attack strong colonies. They are more commonly found in weak colonies. If a hive becomes infested with these moths, the bees may be transferred to a new hive, and the old hive should be fumigated by placing it in a tightly covered box and using carbon bisulfide. A few spoonsful of this liquid should be put in a saucer in the top of the box and then the lid closed tightly. The liquid soon evaporates and kills every living thing within. After a few hours remove the hive and thoroughly scrape and clean all of the parts before using it again.

Robber bees are often wild black bees or other neighboring bees. As strong hives are seldom seriously robbed, the robbing is considered a sign of weakness of the colony. The remedy would be to combine the colony with another one. Robbing is seldom a gradual matter. It may be akin to a riot, to be promptly subdued. Avoid it by allowing no honey to be exposed during a dearth of honey flow. Keep all colonies strong.

Honey thieves may visit the apiaries in the form of bad boys, bears, or others who crave honey. 'Possums have been known to rob colonies if they acquire a taste for honey. Boys have been known to tip over hives purely from mischief. Yards may be fenced tightly to keep away such enemies.

Job 5. Marketing Products

Conditions Usually Found.—(1) Extracted honey and chunk honey are the chief products sold from large yards. (2) Some professional producers put out section honey in large quantities. (3) Small yards more commonly sell comb honey.

Aims.—Students should know the best methods of preparing products for market and of selling them.

Problems for Study and Discussion.—(1) Inquire among local beekeepers and find what their practices are regarding the preparation of honey for market.

2. How many hives are necessary to justify the owner in extracting honey?
3. Compare prices received for the different products.
4. Compare summer and fall prices with those in winter and spring.
5. Which of the products can be more easily stored and held for winter prices?
6. Compare the amounts of comb and extracted honey from equal colonies.
7. What yields do different beekeepers report?
8. Describe methods of preparing extracted honey for market.
9. In what kinds of containers is it sold?
10. Describe or show some of the labels used in selling honey.
11. Describe handling of comb honey in frames to prevent damage during marketing.
12. Describe the rearing and sale of queens.
13. What benefit may come from exhibits at fairs?
14. How can coöperation among beekeepers aid in marketing?

Activities.—(1) Assist in the trimming and packing of comb honey for market. (2) Practise extracting honey and bottling or otherwise preparing it for market. (3) Canvass the stores and obtain orders for honey. (4) Make deliveries and collections at suitable times. (5) Assist in the preparation of a bee-and-honey exhibit at a fair.

The Comb Honey Product.—Perfectly white honey with all of the cells firmly capped and each section well filled makes a first class product for the best markets. It is difficult to handle sections of honey without causing some of the cells to leak before the product reaches the consumer. Great care must be exercised in removing the sections from the hive, cleaning them up for the best appearance in the market, and transferring them to dealers or to consumers. It is evident that the best comb honey cannot be very easily transferred long distances to market. This product is therefore more commonly sold in nearby markets or used by customers who come to the apiary for it. If a leaking of sections occurs after the sale is made, the customer is usually not dissatisfied.

In spite of these difficulties comb honey is successfully shipped in carload lots from California to New York.

Chunk honey is a term given to comb honey which has been cut out of the sections or larger combs and is sold in mass in other containers. It satisfies some consumers better than extracted honey. The use of some chunk honey in vessels chiefly filled with extracted honey also helps the appearance in the minds of some dealers and some customers.

Extracted Honey.—Almost all large yards use centrifugal extractors and chiefly sell extracted honey. Federal and state laws are rigid regarding the adulteration of extracted honey by the adding of sirups. Rewards are offered by beekeepers' associations for evidence of such mixtures. Honey users are gradually becoming convinced that extracted honey is as pure as and more wholesome than comb honey. When honey is extracted from combs the combs are returned to the hives and bees save much of their time and energy by not having to produce wax and rebuild comb. They can therefore make from twenty-five to fifty per cent more honey if there is plenty of nectar available. The cost of extracting honey is less than the cost of careful handling of comb honey in sections. The equipment, however, is an expense which must be considered at first. Extracted honey can be shipped any desired distance without damage.

Honey Containers.—Wholesalers of honey often handle extracted honey in large cans. Retailers often place the product in glass bottles and jars of suitable size to suit customers. Appropriate labels showing the source of the honey are often placed on containers.

Prices.—Extracted honey usually sells at prices somewhat lower than comb honey in sections. As a rule the price for honey in summer and fall is lower than in winter and spring. It is difficult to hold comb honey for higher prices because the sections begin to leak. Extracted honey placed in large containers may be easily stored for several months if desired.

Fair exhibits help to educate the public in the use of honey. They may be made very attractive, and large crowds of people may be interested in them.

Queen Rearing.—A few beekeepers make a business of rearing queens of superior quality for sale to others. Many beekeepers desire to improve their strain of bees by introducing good queens from time to time. For a good understanding of the methods in this phase of the business, reference is made to bulletins and special beekeeping books.

Coöperation among beekeepers may aid them in a number of ways: (1) They secure better markets for products. (2) Uniform labels help to advertise. (3) Products are better standardized. (4) They can hold honey from one season to another more easily. (5) Better prices are usually secured. (6) Diseases may be more easily controlled. (7) More help may be secured from state beekeepers' associations. (8) They can enforce laws more rigidly. (9) They can make better exhibits at fairs and advertise products better.

APPENDIX

REFERENCE BOOKS

Anthony, *Dairy Laboratory Manual* (Lippincott).

Bray and Schmidt, *Activities in Animal Husbandry* (Practice Manual), (Century).

Chapman, *Livestock and Poultry* (Smith-Hammond).

Craig, *Common Diseases of Farm Animals* (Lippincott).

Curtis, *Livestock Judging* (Lee-Febiger).

Davenport, *American Livestock Judging* (Drover's Journal).

Gay, *Livestock Judging* (Macmillan).

Harper, *Manuals of Farm Animals* (Macmillan).

Helser, *Farm Meats* (Macmillan).

Henry and Morrison, *Feeds and Feeding* (Authors, Madison).

Horner, *Agricultural Marketing* (Wiley).

Jesness, *Coöperative Marketing* (Lippincott).

Lewis, *Poultry Laboratory Manual* (Lippincott).

Malin, *The Evolution of Breeds* (Wallace's Forum).

Plumb, *Types and Breeds of Farm Animals* (Ginn).

Plumb, *Judging Animals* (Judd).

Smith, *Livestock Judging* (Lippincott).

Tomhave, *Meats and Meat Products* (Lippincott).

U. S. D. A., *Diseases of Cattle.*

U. S. D. A., *Diseases of Horses.*

Vaughan, *Types and Market Classes of Livestock* (Adams).

Winters, *Animal Breeding* (Wiley).

Woll, *Productive Feeding of Farm Animals* (Lippincott).

Woll, *Feeding Laboratory Manual* (Lippincott).

See also special books in list in front of this volume, and in each enterprise.

LIVESTOCK BREED ASSOCIATIONS

(Write for registration blanks and rules; also pictures of typical animals, and lists of breeders in your state.)

Beef and Dual-Purpose Cattle

Am. Aberdeen-Angus Br. Assn., 817 Exchange Ave., Chicago.

Am. Devon Cattle Club, 51 Cornhill St., Boston, Mass.

Am. Galloway Br. Assn., Carrollton, Mo.

Am. Hereford Cattle Br. Assn., 1012 Baltimore Ave., Kansas City, Mo.

Am. Polled Shorthorn Br. Soc., Hannibal, Wis.

Am. Polled Hereford Br. Assn., Des Moines, Ia.

Red Polled Cattle Club of Am., Richland Center, Wis.

Am. Shorthorn Br. Assn., 13 Dexter Park Ave., Chicago.

Dairy Cattle

Ayrshire Br. Assn., Brandon, Vt.

Brown Swiss Cattle Br. Assn., Beloit, Wis.

Dutch Belted Cattle Assn. of Am., Rockville, Conn.

Am. Guernsey Cattle Club, Peterboro, N. H.

Holstein-Friesian Assn. of Am., Brattleboro, Vt.

Am. Jersey Cattle Club, 324 W. 23d St., N. Y.

Am. Kerry and Dexter Cattle Club, Columbus, O.

Horse and Jacks

Arabian Horse Club of Am., Milan, N. H.

Am. Assn. of Belgian Draft Horses, Wabash, Ind.

Cleveland Bay Society of Am., 72 W. Adams St., Chicago.

American Clydesdale Assn., Union Stock Yards, Chicago.

French Coach Horse Soc. of Am., Oak Park, Ill.

French Coach Horse Registry, Columbus, O.

National French Draft Horse Assn., Fairfield, Ia.

German, Hanoverian, and Oldenburg Coach Horse Assn. of Am., LaFayette, Ind.

Am. Hackney Horse Soc., Merrick, L. I., N. Y.

Am. Morgan Horse Register, 3 E. 44th St., N. Y.

Percheron Soc. of Am., Union Stock Yards, Chicago.

Am. Br. and Im. Percheron Reg. Co., Plainfield, O.

Am. Saddle Horse Br. Assn., 434 W. Main St., Louisville, Ky.

Am. Shetland Pony Club, LaFayette, Ind.

Am. Shire Horse Assn., Tonica, Ill.

Am. Suffolk Horse Assn., 72 W. Adams St., Chicago.

Am. Trotting Register Assn., 5253 W. Harrison St., Chicago.

Jockey Club, 66 W. 40th St., N. Y.

Welsh Pony and Cob Soc. of Am., LaFayette, Ind.

Standard Jack and Jennet Reg. of Am., Scarritt Bldg., Kansas City, Mo.

Sheep and Goats

Am. Cheviot Sheep Soc., Chestnut Hill, Pa.

Am. Corriedale Assn., Cheyenne, Wyo.

Am. Cotswold Registry Assn., Wheaton, Ill.

Continental Dorset Club, Mechanicsburg, O.

Am. Hampshire Sheep Assn., 72 Woodland Ave., Detroit, Mich.

Am. Leicester Br. Assn., Cameron, Ill.

Natl. Lincoln Sheep Br. Assn., Marlette, Mich.

Am. and Delaine Merino Record Assn., Xenia, O.

Am. Rambouillet Sheep Br. Assn., Marysville, O.

Am. Oxford Down Record Assn., Hamilton, O.

Am. Romney Br. Assn., Manhattan, Kas.

Am., Shropshire Registry Assn., LaFayette, Ind.

Am. Southdown Br. Assn., State College, Pa.

Am. Tunis Sheep Br. Assn., Bainbridge, Ind.

Am. Fur Sheep Registry Assn., Box 779, Syracuse, N. Y.

Am. Angora Goat Br. Assn., Reeds Spring, Mo.

Am. Milch Goat Record Assn., Vincennes, Ind.

Internatl. Nubian Br. Assn., La Jolla, Cal.

Swine

Am. Berkshire Assn., Springfield, Ill.

Kentucky Red Berkshire Assn., Richmond, Ky.

Am. Large Black Pig Soc., Lexington, Ky.

Cheshire Swine Br. Assn., Freeville, N. Y.

Chester White Swine Record Assn., Rochester, Ind.

O. I. C. Swine Br. Assn., Goshen, Ind.

Am. Duroc-Jersey Assn., 817 Exchange Ave., Chicago.

Natl. Duroc-Jersey Record Assn., Peoria, Ill.

Am. Essex Swine Assn., New London, Ia.

Am. Hampshire Swine Record Assn., 409 Wis. Ave., Peoria, Ill.

Natl. Mule-Foot Hog Assn., DeGraff, Ohio.

Am. Mule-Foot Hog Record Assn., Wyandotte Bldg., Columbus, O.

Am. Poland China Record Assn., Transportation Bldg., Chicago.

Natl. Poland China Record Assn., Winchester, Ind.

Standard Poland China Record Assn., Maryville, Mo.

Natl. Spotted Poland China Record Assn., Wulsin Bldg., Indianapolis, Ind.

Am. Spotted Poland China Record Assn., Jamesport, Mo.

Am. Tamworth Swine Record Assn., Ames, Ia.

Am. Yorkshire Club, Fairview Inn, St. Paul, Minn.

AVERAGE COMPOSITION OF BARNYARD MANURES

Barnyard Manures	Pounds per Thousand			Value per Year 1000 lbs. Live Weight	Value per Ton of Manure[1]
	Nitrogen N	Phosphoric Acid, P_2O_5	Potash, K_2O		
Cow manure (fresh)	3.4	1.6	4.0	$39.00	$1.91
Horse manure (fresh)	5.8	2.8	5.3	42.00	3.13
Sheep manure (fresh)	8.3	2.3	6.7	46.00	4.20
Hog manure (fresh)	4.5	1.9	6.0	80.00	2.56
Hen droppings (fresh)	16.3	15.4	8.5		9.12
Mixed stable manure	5.0	2.6	6.3		2.88

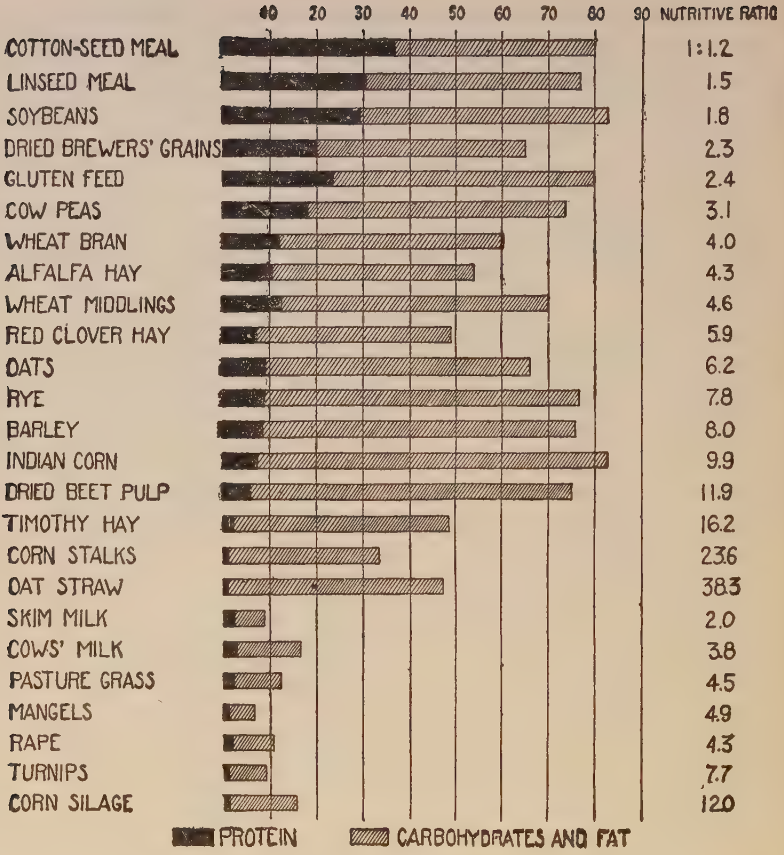
[1] Considering nitrogen at 20 cents, phosphoric acid at 6 cents, and potash at 4½ cents per pound.

STATE AGRICULTURAL EXPERIMENT STATIONS

Address the director in asking for bulletins and information. The Agricultural College is at the same place, unless starred (*). Write also to the Superintendent of Documents, Washington, D. C., for lists of available bulletins and circulars.

Alabama—
  College Station: *Auburn.*
  *Canebrake Station: *Uniontown.*
  *Tuskegee Station: *Tuskegee.*
*__Alaska__—*Sitka.*
Arizona—*Tucson.*
Arkansas—*Fayetteville.*
California—*Berkeley.*
Colorado—*Fort Collins.*
Connecticut—
  *State Station: *New Haven.*
  Storrs Station: *Storrs.*
Delaware—*Newark.*
Florida—*Gainesville.*
Georgia—*Experiment.*
  *Coastal Station: *Tifton.*
*__Guam__—*Island of Guam.*
Hawaii—*Honolulu.*
Idaho—*Moscow.*
Illinois—*Urbana.*
Indiana—*Lafayette.*
Iowa—*Ames.*
Kansas—*Manhattan.*
Kentucky—*Lexington.*
Louisiana—*Baton Rouge.*
Maine—*Orono.*
Maryland—*College Park.*
Massachusetts—*Amherst.*
Michigan—*East Lansing.*
Minnesota—*University Farm, St. Paul.*
Mississippi—*Agricultural College.*
Missouri—
  College Station: *Columbia.*
  *Fruit Station: *Mountain Grove.*
  *Poultry Station: *Mountain Grove.*
Montana—*Bozeman.*
Nebraska—*Lincoln.*
Nevada—*Reno.*
New Hampshire—*Durham.*
New Jersey—*New Brunswick.*
New Mexico—*Agricultural College.*
New York—
  *State Station: *Geneva.*
  Cornell Station: *Ithaca.*
North Carolina—*Raleigh.*
North Dakota—*Agricultural College*
*__Ohio__—*Wooster.*
Oklahoma—*Stillwater.*
Oregon—*Corvallis.*
Pennsylvania—*State College.*
Porto Rico—*Mayaguez.*
Rhode Island—*Kingston.*
South Carolina—*Clemson College.*
South Dakota—*Brookings.*
Tennessee—*Knoxville.*
Texas—*College Station.*
Utah—*Logan.*
Vermont—*Burlington.*
Virginia—*Blacksburg.*
Washington—*Pullman.*
West Virginia—*Morgantown.*
Wisconsin—*Madison.*
Wyoming—*Laramie.*

In Canada write to Agricultural College at Guelph, Winnipeg, or St. Anne de Bellevue.* Dominion Department of Agriculture, Ottawa.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NUTRITIVE RATIO
COTTON-SEED MEAL
1:1.2
LINSEED MEAL
1.5
SOYBEANS
1.8
DRIED BREWERS' GRAINS
2.3
GLUTEN FEED
2.4
COW PEAS
3.1
WHEAT BRAN
4.0
ALFALFA HAY
4.3
WHEAT MIDDLINGS
4.6
RED CLOVER HAY
5.9
OATS
6.2
RYE
7.8
BARLEY
8.0
INDIAN CORN
9.9
DRIED BEET PULP
11.9
TIMOTHY HAY
16.2
CORN STALKS
23.6
OAT STRAW
38.3
SKIM MILK
2.0
COWS' MILK
3.8
PASTURE GRASS
4.5
MANGELS
4.9
RAPE
4.3
TURNIPS
7.7
CORN SILAGE
12.0
PROTEIN
CARBOHYDRATES AND FAT

Average Weights of Concentrated Feeding Stuffs

Feeding stuff.	One quart weighs, pounds.	One pound measures, quarts.
Alfalfa meal	.6	1.7
Barley meal	1.1	.9
Barley, whole	1.5	.7
Beet pulp, dried	.6	1.8
Brewers' grains, dried	.6	1.7
Buckwheat bran	.6	1.7
Buckwheat middlings	.9	1.1
Cocoanut meal	1.5	.7
Corn-and-cob meal	1.4	.7
Corn and oat feed	.7	1.4
Corn bran	.5	2.0
Corn meal	1.5	.7
Corn, whole	1.7	.6
Cotton seed	1.0	1.0
Cotton-seed hulls	.3	3.3
Cotton-seed meal	1.5	.7
Distillers' grains, dried	.6	1.7
Germ oil meal	1.4	.7
Gluten feed	1.3	.8
Gluten meal	1.7	.6
Hominy meal	1.1	.9
Kafir meal	1.6	.6
Linseed meal (new-process)	.9	1.1
Linseed meal (old-process)	1.1	.9
Malt sprouts	.6	1.7
Mixed mill feed (bran and middlings)	.6	1.7
Molasses	3.0	.3
Molasses beet pulp	.8	1.3
Oat feed	.8	1.3
Oat middlings	1.5	.7
Oats, whole	1.0	1.0
Rice bran	.8	1.3
Rice polish	1.2	.8
Rye bran	.6	1.7
Rye feed (rye bran and rye middlings)	1.3	.8
Rye meal	1.5	.7
Rye, whole	1.7	.6
Wheat bran	.5	2.0
Wheat feed, mixed	.6	1.7
Wheat, ground	1.7	.6
Wheat middlings (flour)	1.2	.8
Wheat middlings (standard)	.8	1.3
Wheat, whole	1.9	.5
Wheat screenings	1.0	1.0

PRODUCTION AND PRICES FOR THE UNITED STATES, 1926

	No.	Farm Value	Ave. Price Each
Horses and colts	15,840,000	$1,036,896,000	$65.46
Mules and colts	5,783,000	466,988,000	81.46
Dairy cattle, over 2 yrs	22,148,000	1,270,521,000	57.37
All cattle and calves	59,148,000	2,290,275,000	38.72
Swine	52,055,000	791,632,000	15.20
Sheep	39,864,000	418,965,000	10.51

	Production, lbs.
Wool (raw) (595,979,000 lbs. consumed)	310,901,000
Dressed mutton	500,888,000
Dressed beef	5,225,909,000
Dressed veal	530,604,000
Dressed pork	7,272,534,000
Creamery butter	1,361,526,000
Farm butter	590,000,000
Cheese (not cottage)	443,514,000 (ave. 23c)
Whole milk (47% so used)	116,505,000,000
Cond. and evap. milk	1,757,858,000
Poultry, dressed (5 cities)	355,815,000
Eggs (5 cities)	15,511,000 (cases)
Eggs, cold storage	3,215,000 (cases)

	Ave. Prices
Beef cattle	$ 6.46 cwt.
Swine	11.80 cwt.
Sheep	7.38 cwt.
Lambs	11.57 cwt.
Butter	.41 lb.
Chickens	.207 lb.
Turkeys	.316 lb.
Eggs	.283 doz.
Comb honey	3.60 to 4.75 case of 24 sec.
Extracted honey	6¾ to 11¼c per lb.
Wax	31 to 40c per lb.

Digestible Nutrients and Fertilizing Values of Feeds

NAME OF FEED l = laxative c = constipating	DRY MATTER IN 100 POUNDS	DIGESTIBLE PARTS IN 100 POUNDS		FERTILITY IN 1000 POUNDS		
		Protein	Carbohydrates (+fat ×2¼)	Nitrogen (N)	Phosphoric acid (P_2O_5)	Potash (K_2O)
Alfalfa, green	28.2	3.6	13.0	7.7	1.3	5.6
Alfalfa, hay	93.6	11.7	43.1	26.1	6.1	17.9
Barley	89.2	8.4	68.9	19.2	7.9	4.8
Beet pulp, dry	91.6	4.1	65.1	12.9	2.2	3.1
Beets, sugar	13.5	1.3	10.0	2.9	0.8	3.7
Blood, dried	91.5	70.9	5.6	135.0	13.5	7.7
Buckwheat	86.6	8.1	53.6	17.3	6.9	3.0
Buckwheat bran	91.8	5.9	38.5	20.2	4.2	12.7
Buckwheat flour	85.4	5.9	65.7	11.0	6.8	3.4
Buckwheat hulls	86.8	1.2	29.7	7.3	4.3	14.7
Buckwheat middlings	87.2	22.7	51.2	42.7	12.3	11.4
Corn, dent	89.4	7.8	76.5	16.5	7.1	5.7
Corn, flint	88.7	8.0	75.9	16.8	7.1	5.7
Corn, sweet	91.2	8.8	79.5	18.6	7.1	5.7
Corn, ensilage	26.4	1.4	15.7	4.3	1.1	3.7
Corn fodder, green	20.7	1.0	12.8	2.9	1.1	3.9
Cornmeal (all)	85.0	6.7	72.2	14.7	6.3	4.7
Corn stalks with ears	57.8	2.5	37.3	7.2	5.4	8.9
Corn stover, no ears (c)	59.5	1.4	32.7	6.1	3.8	10.9
Corn and cob meal	84.9	4.4	66.5	13.6	5.7	4.7
Corn gluten meal	90.5	29.7	56.2	54.8	3.3	0.5
Cornhearts, hominy feed	90.4	6.8	77.2	16.8	9.8	4.9
Canada field peas	85.0	19.7	50.2	37.9	8.4	10.1
Canada pea meal	89.5	16.8	53.3	32.3	8.2	9.9
Cotton seed	89.7	12.5	68.9	29.4	10.5	10.9
Cottonseed meal (c)	93.0	37.6	43.0	72.5	30.4	15.8
Cottonseed hulls	88.9	0.3	37.0	6.7	4.3	10.4
Clover hay, red	84.7	7.1	41.8	19.7	5.5	18.7
Clover hay, alsike	90.3	8.4	42.2	20.5	5.0	13.9
Clover hay, crimson	90.4	10.5	37.6	24.3	4.0	13.1
Clover green (red)	29.2	2.9	16.4	7.0	1.5	4.8
Clover hay, sweet	92.1	11.9	37.8	28.8	5.6	18.3
Clover, sweet, dry	92.0	12.0	38.0	29.0	5.6	18.0
Cowpeas, green plants	16.4	1.8	9.2	3.8	1.3	4.6
Cowpea hay	89.5	9.2	32.2	14.3	5.2	14.7
Cowpea seed	85.4	16.8	59.2	32.8	10.1	12.0
Dwarf Essex rape, green	14.3	2.0	8.7	3.5	1.2	3.5
Flaxseed	90.8	20.6	82.4	36.2	13.9	10.3
Kafir (or Milo) grain (c)	90.1	5.2	47.5	17.9	......	......
Kafir dry fodder	91.0	4.1	48.8	14.2	......	......
Kentucky blue-grass, green	34.9	2.8	21.5	6.6	2.5	7.0
Kentucky blue-grass, hay	86.0	4.4	41.8	12.5	4.0	15.7
Linseed meal (old pro.) (l)	90.2	30.2	47.5	54.2	16.6	13.7
Linseed meal (new pro.) (l)	91.0	31.5	41.1	60.0	17.4	13.4
Meat and bonemeal	94.0	36.7	29.4	63.2	146.8	......

Digestible Nutrients and Fertilizing Values of Feeds—Continued

NAME OF FEED l =laxative c =constipating	DRY MATTER IN 100 POUNDS	DIGESTIBLE PARTS IN 100 POUNDS		FERTILITY IN 1000 POUNDS		
		Protein	Carbo-hydrates (+fat ×2¼)	Nitrogen (N)	Phosphoric acid (P_2O_5)	Potash (K_2O)
Meat meal	89.3	66.2	29.2	114.0	81.1	......
Milk, skim	9.4	2.9	6.1	5.0	2.1	2.0
Buttermilk	9.9	3.8	6.2	6.4	1.7	1.6
Whey	6.2	0.6	5.5	1.0	1.1	2.0
Milk, whole	12.8	3.4	13.1	5.8	1.9	1.7
Mangels	9.1	1.0	5.9	2.2	0.9	3.8
Millet seed	87.9	7.1	54.1	17.4	6.5	3.3
Mixed grasses, green	20.0	2.5	11.2	5.6	2.6	7.4
Mixed grasses, hay	84.7	4.2	44.9	11.9	2.7	15.5
Molasses, cane (l)	74.1	1.4	59.2	4.3	1.2	36.8
Molasses, beet (l)	79.0	4.7	54.0	14.5	0.5	56.3
Oats	89.6	10.7	58.7	18.2	7.8	4.8
Oat hay	86.0	4.7	40.5	14.2	6.7	25.4
Oat hulls	92.6	1.3	39.9	5.3	1.6	4.9
Oat meal	92.1	11.9	80.2	23.5	......	......
Oat middlings	91.2	13.1	69.3	25.9	22.5	15.3
Oat and pea hay	89.5	7.6	44.9	16.5	6.1	18.1
Oat straw	90.8	1.3	41.3	5.8	3.0	17.7
Orchard grass, green	27.0	1.2	14.5	4.2	1.6	7.6
Orchard grass, hay	90.1	4.9	45.6	12.9	3.7	16.9
Peanut kernels (no hull)	92.3	25.1	93.8	44.6	12.4	12.7
Peanut meal (or cake)	89.3	42.8	36.6	76.2	20.0	15.0
Peanut vine hay	92.4	6.7	49.0	17.1	3.2	11.6
Rice	87.6	6.4	80.1	11.8	1.8	0.9
Rice bran	90.3	7.6	54.2	19.0	2.9	2.4
Rice hulls	91.2	0.3	20.1	5.1	1.7	1.4
Rice meal	89.8	7.4	75.1	19.2	......	......
Rice polish	89.2	7.9	70.5	19.0	26.7	7.1
Rye	91.3	9.5	72.1	18.1	8.6	5.8
Rye bran	88.4	11.2	50.9	23.3	22.8	14.0
Rye middlings	88.2	11.0	58.8	22.9	12.3	9.6
Rye straw	92.9	0.7	40.5	5.0	2.5	8.6
Sorghum seed (c)	87.0	4.5	69.4	14.6	8.4	3.4
Soybean hay	88.2	10.6	43.6	23.8	5.2	14.7
Soybean seed	88.3	29.1	56.2	53.6	10.4	12.6
Sudan, hay	88.4	3.7	47.7	13.1	4.2	11.3
Tankage	93.0	50.1	26.1	86.2	139.0	3.0
Timothy, green	38.4	1.5	21.2	5.0	2.6	7.6
Timothy, hay	86.8	2.8	45.3	9.4	3.3	14.2
Velvet bean, vine cured	90.0	9.6	55.7	22.4	......	......
Vetch, hairy, hay	88.7	11.9	44.3	27.2	9.7	24.4
Wheat	89.5	8.8	70.8	19.0	5.5	8.7
Wheat bran (winter) (l)	88.5	12.5	43.4	25.1	26.9	15.2
Wheat—red dog flour	90.1	16.2	64.7	29.4	......	......
Wheat middlings	88.8	13.0	55.8	27.0	26.3	15.3
Wheat straw	90.4	0.8	44.2	5.0	2.2	6.3
Wheat screenings	88.4	9.6	52.5	20.0	11.7	8.4

INDEX

A

Abdomen, layer, 371, 372
Aberdeen Angus cattle, 105, 107
Abortion, contagious, 61, 134
Accidents, horse, 208
Accounts, swine, 276
Accredit rules, 402, 409
Accredited, flock, 402
  hatchery, 409
Acid, testing, 66
Activities, see the jobs
Advanced registry, 58
Advertising, cattle, 144
  sheep, 343
  swine, 269
  value, 82
Age, horse, 191–193
  in cows, 19, 20
  sheep, 308
Air, poultry house, 391, 392
Albumen, milk, 86
Alfalfa, beef farm, 120
  sheep pasture, 317
  swine, 258
    results, 265
All-mash, chicks, 419
  egg rations, 383, 384
American, cheese, 96
  Merino, 299–301
  Saddle Horse, 179, 180
Analysis, beef cattle, 165
  beekeeping, 449
  dairy, 1
  horse and mule, 165
  poultry, 351
  sheep, 281
  swine, 223
Ancestors, dairy cattle, 20
Ancona pair, 366
Angora goats, pasture, 285
Animal, protein, hens, 385
  registration, 129, 130
Apiary care, 454–458
Arabian stallion, 178
Artificial lighting, 389, 390
Assembling eggs, 443
Association, cow-improvement, 58
  cow-test, 58
Associations, breed, 463–465
  bull, 113
A-type house, swine, 228, 231
Auction sales, 114
Auctions, cattle, 144
  swine, 269
Ayrshire, breed, 7–9
  butter-fat, 9
  importations, 9
  milk, 8, 9
  records, 9
Azoturia, horse, 212

B

Babcock, glassware, 70
  methods, testing, 64–72
  tester, 64
  test operations, 66–69
  test precautions, 68
Baby beef, feeding, 140
    plans, 131, 132
    popularity, 141
    producing, 139–141
    projects, 139, 140
    type, 140
Baby chicks, 406–413
Bacillary diarrhœa, 424
Bacon type, 232, 236
    score card, 243, 244
Balance, nutrients, hens, 380
Balanced ration, 44
    horse, 204
    swine, 262–264
Balancing rations, 44–48
Barley, beardless, 122
Barn, alley, horse, 196
  ceiling, 76
  construction, horse, 196
  dairy, 51, 73–81
  feed room, 78
  floor, horse, 196
  floors, 76
  gutter, 75, 76
  interior, 51, 75
    horse, 196
  light, 77
  location, 73, 115, 116
    horse, 196
  mangers, 75, 76
  report, dairy, 55
  size, 75
  stalls, 78

Barn, stanchions, 75, 76
  tools, 79, 80
  type, 74
  ventilation, 77
  walls, 76
  water, 78
Barns, cattle, 114–118
  horse and mule, 195–197
  sanitary, 74
  sheep, 314, 315
Bedding, swine cars, 271
Bee benefits, 450
  bulletins, 449
  business, starting, 451–454
  capital, 450
  colony, 451
  diseases, 450
  enemies, 450, 458, 459
  enterprise, 449–461
  income, 450
  knowledge, 449
  labor, 450
  location, 450
  moths, 459
  possibilities, 449
  products, showing, 461
  races, 451
  references, 449
  things to make, 451
  yard, 452
Beef, analysis, 99
  baby, 131, 132
    projects, 139–141
  breeds, 101–109
    compared, 108
  butchering, 158–160
  calves, care, 133
  cattle, barns, 114–118
    buildings, 100
    bulletins, 164
    crops, 118–123
    diseases, 134–138
    feeding, 151–154
    feeds, 101
    fences, 100
    hay, 120, 123
    judging, 109–114
    marketing, 154–158
    origin, 109
    prices, 157
    references, 99, 164
    shipping, 155
    showing, 141–144
    silo, 147
    weights, 147
    wintering, 145–147
  characteristics, 112
  cuts, 159
Beef, enterprise, 99–164
  farm, lease, 101
    rotations, 121, 122
    size, 100
  financing, 101
  general appearance, 112
  heifers, 112
  herd, management, 131–133
  jobs, 99
  killing, 159
  pasture, 101
  pastures, 120, 121–127
  possibilities, 99–101
  ring, 158–160
  score card, 111
  shipping, 101
  skinning, 160
  things to make, 115
  type, 102
  vs. other food, 3
Beef-calf project, 111
Beekeeping, analysis, 449
  jobs, 449
  liking, 449
  starting, 451
Bees, buying, 452
  care, 454–458
  dividing, 458
  examining, 455
  feeding, 557
  German, 451
  Italian, 451
  uniting, 456
Belgian, horse, 173, 174
  mare and offspring, 198
  stallion, 219
Berkshire, swine, 236
Birds for show, 436
Bitting harness, colt, 201
Blackleg, 135
Bleeding hogs, 273
Blindness, horse, 190
Bloat, calf, 39
  cattle, 62
Blue-grass pasture, 120, 124
  sheep, 316
  swine, 259
Boar, handling, 247
Boars, culling, 248
Bog spavin, 191
Bone spavin, 191
Book references, 463
Bottles, iced milk, 91
Bottling milk, 90
Box-stalls, 78
Brahma, light, 364
Breaking colts, 200–202
Breathing, poultry, 392

Breed, association field man, 144
  associations, 463–465
  Ayrshire, 7–9
  Brown Swiss, 14, 15
  choosing, dairy, 6
    poultry, 365
  climate for, 7
  community, 6
  Dairy Shorthorn, 17
  Dutch Belted, 15, 16
  French Canadian, 16
  Guernsey, 9, 10
  Holstein, 12–14
  Jersey, 11, 12
  popularity, 7
  preferences, 7
  prepotency, 7
  prices, 7
  records, (each breed)
  Red Polled, 16
  surface for, 7
  type, sheep, 311
  types, egg, 360–362
    meat, 362
Breeding, age, dairy, 40
    gilts, 246
  better sheep, 338
  cattle, showing, 141–144
  cocks, 404
  community, 59, 113
  dairy, 49
  ewes feeding, 310
  flock, poultry, 400, 401
  hens, number, 406
  horse, 218
  horses, judging, 185
  pen, 402
  poultry, 399–406
  qualities, poultry, 400
  record, 55
    swine, 276, 277
  season, swine, 246
  sheep judging, 311
    selling, 342, 343
    showing, 342, 343
  stock, 109–114
  swine, care, 244–248
    selling, 264–269
Breeds, see also each class
  beef, 101–109
  dairy, 4–17
  development, 109
  draft horse, 173–176
  horse and mule, 171–183
  lard or fat, 232–235
  light-horse, 177–180
  poultry, 360–365
Breeds, sheep, 286–302
  swine, 231–237
Bridle, horse, 208
Brine curing pork, 275
Brood, bee, 455
  mares, labor, 217
Brooder, house, 414–417
    building, 415
    preparation, 417
    temperature, 418
  record, 433
  round-house, 416
  stove, 416
Brooding, chicks, 413–418
  condition, 414, 415
  place, 414, 415
Broilers, Easter, 422
Brown Swiss, 6
    breed, 14, 15
    butter-fat, 15
    cattle, 107, 108
    characteristics, 15
    importations, 15
    milk, 15
    records, 15
Bruises, horse, 213
Building, breeding flock, 400
  poultry house, 398, 399
Buildings, arrangement, 73, 74
  beef cattle, 100
  dairy, 73–81
Bull, age, 113
  associations, 113
  community, 59
  dairy, 49
  first use, 40
  score card, 23
Bulletins, bee, 449
  beef cattle, 164
  poultry, 351, 447
  sheep, 281
  swine, 223, 279
Bunk, feed, 132
  repairing, 146
Bunks, feeding, 152
Butchering, cattle, 158–160
  equipment, 272
  sheep, 347–350
  swine, 272–276
Butter, creamery, 93
  factory, 95
  home made, 93, 94
  making, 93–95
  overrun, 94
  prices, 95
  room, 94

Butter, selling, 95
  vs. market milk, 95
Butter-fat, Ayrshire, 9
  Brown Swiss, 15
  described, 86
  Dutch Belted, 16
  Guernsey, 9
  Holstein, 13, 14
  Jersey, 12
  Red Polled, 17
  Shorthorn, 17
  testing, 57, 58, 64–72
  variation, 64, 65, 71
Buttermilk testing, 68
Buying, bees, 452
  cattle, 113, 114
  chicks, 407, 408
  ewes, 239
  feeds, 127–129
  sheep, 303
  steers, 147–151
  swine, 239

C

Calculating rations, 44–48
Calf, care, 31–40
  diseases, 38, 39
  fall, 50
  feed records, 54
  feeding, 33–36
  gains, 37, 38
  grain, 33, 34
  hay, 35
  horns, 36
  lice, 39
  management, 35
  marking, 37
  registering, 37
  shelter, 39
  stalls, 36
  stanchions, 35, 36
  weaning, 141
  weights, 38
California Stamp, 143
Calves, care, 133
  dairy, 31–40
  showing, 141–144
Cannibalism, chicks, 425
Capacity, layer, 376
Capital, bees, 450
Capons, producing, 446
Car, swine shipping, 271
Carbohydrates in rations, 44
Carcass, beef, 159, 160
  sheep, 349, 350
  swine, 273, 274
Care, apiary, 454–458
  calves, 31–40
  cow and calf, 32
  cream, 89
  dairy herd, 49–53
  feet, 63
  hatching eggs, 410
  lambing time, 324–328
  mare and foal, 198, 199
  of feet, horse, 206, 207
  poultry house, 399
  pregnant ewes, 321
  pullets, 422
  sheep, 318, 319
  sheared sheep, 341
  sow and litter, 252–255
  swine, 244–248
  work stock, 205–210
  young, bull, 40
    stock, 31–40
Carriedale sheep, 294
Carrier, feed, 78
Casein, 86
Castration, cattle, 138
  lamb, 330, 331
  swine, 255
Catalogs, cattle sale, 144
Catching sheep, 304
Cattle, Aberdeen Angus, 105, 107
  advertising, 144
  age factor, 19, 20
  associations, 463, 464
  barns, 114–118
  beef, marketing, 154–158
  bloat, 62
  Brown Swiss, 14, 15, 107, 108
  buying, 113, 114
  castration, 138
  choosing, dairy, 6
  commission men, 156
  community, 100
  compared, 108
  consignments, 156
  coöperative marketing, 156
  dairy, 5–14
  Dairy Shorthorn, 17
  dehorning, 138
  disease control, 113
  diseases, 60–63, 134–138
  drenching, 138
  Dutch Belted, 15, 16
  exhibits, 142–144
  feeding, 151–154
    period, 152
    rations, 153
    winter, 152
  fever, 136
  French Canadian, 16

Cattle, Galloway, 107, 110
  grade dairy, 18, 19
  Guernsey, 9, 10
  Hereford, 104–106
  Holstein, 12–14
  inventory, 161
  Jersey, 11, 12
  lice, 39, 137
  management, 131–133
  marking, 130
  prices, 7, 112, 157
  records, need, 160
    value, 161
  Red Polled, 16, 107, 108
  registration, 129, 130
  scrub, 113
  selecting, 109–114
    dairy, 17–27
  selling, 82–84
  shed, 146
  shipping, 155
  Shorthorn, 102–104, 110
  showing, 82–84
  ticks, 136
  transfers, 130
  troubles, 138
  warbles, 137
  wintering, 145–147
Candling eggs, 412
Celo-glass trial, 386,
Centrifuging, 67
Certified milk, 89
Chapped teats, 62, 63
Cheese, American, 96
  cottage, 97
  making, 96, 97
  room, 97
  vs. market milk, 97
Chester White, at fair, 268
    swine, 235
Cheviot sheep, 294
Chicks, baby, 406–413
  brooding, 413–418
  diarrhœa, 424
  diseases, 424–426
  feed used, 420
  feeding, 418–420
  gain, 420
  hatching vs. buying, 407, 408
  mash, 419, 420
  rations, 418–420
  shipment, 408
  starting, 414
  tray, 412
Choice, grade, sheep, 347
  of beef breed, 102
Cholera, hog, 251
  poultry, 429
Chores, dairy, 52
Chunk honey, 461
Classes, poultry, 360, 361
  sheep, market, 346
Classification, poultry, 361
Climate vs. breed, 7
Clip queen wing, 458
Clipping cows, 90
Clover-blue-grass, mixture, 317
Clover, pigs in, 257, 258
  red and alsike, 257, 258
  sheep pasture, 317
Clydesdale horse, 175, 176
Coach horse, 177–179
Coccidiosis, chicks, 425
Cockerels, separation, 422
Colds, horse, 211
Collar, horse, 208
Colony, bees, 451
Color changes, layers, 375
Colt, feeding, 200
  foaling time, 198
  health, 199
  raising, 197–200
  weaning, 199, 200
Comb, and wattles, layer, 370
  honey, 460
Commercial sheep feeding, 323, 324
Commission firm, 156
Common grade, sheep, 347
Community, breeding, 6, 113
  bull, 59
  jack, 220
  stallion, 220
Comparative score card, 24
Composite sampling, 70
Concentrates, buying, 127–129
  dairy, 44
  horse feed, 203
Condimental feeds, 128
Conditioning, ewes, 320
  ram, 320
Conducting poultry shows, 435, 436
Conformation, dairy, 20
Consignments, cattle, 156
Constitution, hens, 404
  sheep, 311
Construction, hen house, 398
Contagious abortion, 134
Cooler, milk, 80, 81
Cooling cream, 95
Coöperation, beekeepers, 461
  sheep, 345, 346
Coöperative, bull associations, 113
  marketing, cattle, 156
    eggs, 444
    swine, 271

Copper sulfate device, 336
Corn, beef cattle, 119
  hogging-off, 262
  hog ratio, 226
  supplements, swine, 263, 664
Cost, horse barn, 197
  items, horse, 169
  records, eggs, 434
  swine, 224
Costs, horse and mule, 168, 169
Cotswold sheep, 295, 296
Cottage cheese, 97
Counsel, feed lot, 133
Cow and calf, care, 32
  drying-off, 50
Cowpea pasture, swine, 260
Cow-pox, 61
Cow-test association, 58
Cows, fitting for show, 83
  kicking, 51
  throwing, 63
  vs. other animals, 3
Crate, culling, 378
  fattening, 446
Cream, care, 89
  cooling, 95
  holding, 95
  ice cream, 92
  selling, 91
  separators, 72, 81, 94
  testing, 67, 68
  variations, 72
  vs. milk rates, 92
Creamery butter, 93
Crops, beef cattle, 118–123
  dairy pasture, 29
  sheep, 284
    farm, 318
    pasture, 316, 317
  swine, 256
Crowding, chicks, 424
Culling, conditions, hen, 377
  dairy cows, 56–58
  ewes, 339
  factors, egg, 370
  layers, 365–378
  scientific, 370
  swine, 247, 248
  time, hen, 377
Curb, horse, 191
Curing, pork, brine, 275
    dry, 275
Cuts, horse, 213
  of beef, 159
Cutting, swine carcass, 274

D

Daily gains, calf, 38
Dairy barn, 51, 73–81
    report, 55
  breeding, 49
  breeds, 4–17
    reasons, 5
  buildings, 73–81
  bull, 49
    first use, 40
  butter, 93, 94
  calves, 31–40
  cattle ancestors, 20
    conformation, 20
    health, 20
    judging, 19–28
    pedigree, 21
    score cards, 22–24
    selection, 17–27, 56–58
    soundness, 20
    value, 20
  chores, 52
  cow, points, 25–27
    troubles, 63
  disadvantages, 4
  diseases, 60–63
  enemies, 60–63
  enterprise, 1–98
  equipment, 73–81
  feeding, concentrates, 44
    grain in summer, 42
    plenty, 40, 41
    quantity, 41, 43
    roughage, 42, 43
    soiling, 41
    succulent roughage, 42, 43
    summer, 41, 42
    supplemental, 41
  heifer breeding, 40
  herd book, 54
    care, 49–53
    feeding, 40–49
    improvement, 53–59
    starting, 19
  hints, 52
  house equipment, 80, 81
  industry, 1, 2
  job analysis, 1
  labor record, 54
  major enterprise, 3
  pastures, 28–31
  possibilities, 1
  records, 53–56
  references, 1, 98
  rotations, 28–31
  routine, 52
  selling compared, 92

Dairy, sire, 21
  stability, 2
  types, 3, 18, 20, 59
  winter feeding, 42–48
Dam, erosion, 126
David of Dalkeihl, ram, 298
Davis, H. P., 1
Death rates compared, 249
Decline, horse and mule, 169
Dehorning cattle, 138
Delaine sheep, 299–301
Demand, pork, 224
Diarrhœa, chicks, 424
Dickinson, Sherman, 165
Disease, bee, 458, 459
  control, 113
  detecting, 211
Diseases, calf, 38, 39
  cattle, 134–138
  chicks, 424–426
  dairy, 60–63
  horse, 210–214
  listed, swine, 251
  poultry, 424–430
  sheep, 332–337
  swine, 248–252
Disinfecting yards, 427
Disqualification, birds, 437
Distemper, horse, 211
Distribution, poultry, 354
  swine, 224
Dividing bees, 458
Docking lambs, 330
Dogs vs. sheep, 283
Doorways, horse barn, 197
Dorset Horn sheep, 292, 293
Draft horse, breeds, 173–176
    score card, 185, 186
Draft mules, 183
  type, 172
Drenching, cattle, 138
  sheep, 333–336
Dressing poultry, 446
Driving horses, good, 210
Drugs, swine, 250
Dry cow, care, 50
Drying-off cows, 50
Dual, purpose management, 132
Dunlap, David, project, 359, 360
Duroc-Jersey swine, 232, 233
  ton litter, 261
Dutch Belted, breed, 15, 16
    butter-fat, 16
    milk, 15, 16
    records, 16

E

Ear markings, swine, 276, 277
Egg, breed types, 360–362
  districts, 355
  increase, flock, 368
  laying, feed, 379–390
    high, 352
  prices, 445
  production increase, 356
    monthly, 368
  records, 431–433
  regions explained, 355
  standards, number, 368
  type, judging, 437
Eggs, care, 410
  candling, 412, 413
  cooling, 412
  cost record, 434
  gathering, 442
  grading, 442, 443
  hatching, 409
  keeping, 442
  market, 442, 443
  packing, 443
  pullet, hatching, 401
  refrigeration, 441
  retailing, 444
  storing, 443
  turning, 412
  winter production, 352
Enemies, sheep, 332–337
  swine, 248–252
Enterprise, bee, 449–461
  beef, 99–164
  dairy, 1–98
    major, 3
  horse and mule, 165–222
  poultry, 351–447
  sheep, 281–350
  swine, 223–279
Environment, cow, 71
  horse, 219
Equipment, Babcock, 64–66
  beef cattle, 114–118
  butchering, 272
  butter, 94
  dairy, 73–81
  shearing, 341
  sheep, 284, 313–315
    butchering, 348
  swine, 227–231, 254, 255
Erosion, pasture, 126
Evening lunch, 390
Ewe, care, 326
  culling, 339
Ewes, buying better, 339
  conditioning, 320

Ewes, pregnant, 321
  flesh for lambing, 322
  rations, 322, 328
  suckling, 327
Examination, horse, 193, 194
  sheep, 305, 306
Exercise, cattle, 146
Exhibiting, cattle, 142–144
  poultry, 435–440
Expense record, dairy, 54
    form, 162
Experiments, poultry, 352, 353
Extracted honey, 461
Extracting, plans, 454

F

Factory, butter, 95
Fair catalogs, 343
  exhibits, steers, 150, 151
  showing calves, 142
Fairs, bee products, 461
  showing sheep, 343
Fall calves, 50
  freshening, 50
Farm, butchering, sheep, 348
  dairy, 94
  flock, 355
    poultry, 356
  location, swine, 226
  size, beef, 100
Farrowing, after, 254
  before, 253
  house, 228–231
  time, 253
Fat hog type, 232
Fats in rations, 44
Fattening birds, 446
Feed, amount, hens, 379
  bins, horse, 197
  bunk, 132, 146
  carrier, 78
  consumption, hens, 388, 390
  groups, horse, 203
  lot counsel, 133
  needs, horse, 203
  record, 54
    form, 162
  room, dairy, 78
  storage, swine, 230
  table, 467, 468
  vs. milk variation, 71
  vs. product, 3
  winter, 145
Feeder steers, 148–151
    buying, 147–151
Feeding, baby beef, 140
  beef cattle, 151–154
Feeding, bees, 557
  breeding, 319
  bulk, 45
  calf, 33–36
  cattle, methods, 152
    purpose, 152
    rations, 153
    winter, 152
  chicks, 418–420
  colts, 200
  conditions, horse, 205
  dairy, concentrates, 44
    herd, 40–49
    maintenance, 40, 41
    plenty, 40, 41
    production, 40
    quantity, 41, 43
    summer, 41
    soiling, 41
  heavy milkers, 48
  horse, 202–205
  importance, hens, 379, 380
  layers, 379–390
  legume hay, 42, 43
  margins, 148, 149
  market hogs, 260–264
  practice, horse, 205
  roughage, 42, 43
  routine, hens, 383
  shed, 116
  sheep, 318–324
  sow, 253, 254
  standards, horse, 204
  suckling, ewes, 327, 328
  summer grain, 41, 42
  swine, 244–248
  times, swine, 264
  winter, dairy, 42–48
Feeds, buying, 127–129
  condimental, 128
  hauling, distance, 101
  home-grown, 264
Feet, cattle, care. 63
  care, horse, 206, 207
Femininity, ewe, 312
Fences, beef cattle, 100
  sheep, 315
Fertilizing value, feeds, 467, 468
Fever, Texas tick, 136
Field men, breed association, 144
Financing, beef project, 101
  sheep, 303
Fine-wool sheep, 298–302
Finishing cattle, 153
Fistula, horse, 190
Fitting cows for shows, 83
Fleece, care, 340–342
  judging, 311

Fleece, packing, 342
  storing, 342
Flock, accredited, 402
  back-yard, 357
  commercial poultry, 357
  egg, 368
    increase, 368
  farm poultry, 357
  house, 391–399
  poultry breeding, 401
    culling, 365–378
    types, 357
  records, 402, 431–433
  type, sheep, 312, 313
Flocks, farm sheep, 283
Floor, barn, 76
  poultry house, 396
  horse barn, 196
Foal, see colt
Foaling, difficulties, 198, 199
  time, colt, 198
Foot-and-mouth disease, 135
  parts, horse, 207
  trouble, sheep, 337
Forage, swine, 256
  variations, swine, 257
Forms, record, 161–164
  see records, 54–56
Foul brood, bees, 459
Four-horse hitch, 212–214
Fowl, parts named, 438, 439
French Canadian breed, 16
Fresh air, hen house, 391, 392
Freshening, cow, 32
  fall, 50
Full feed, cattle on, 152
Full-feeding swine, 261
Function and type, horse, 172
Fur-bearing sheep, 302

G

Gains, calf, 37, 38
Galloway cattle, 107, 110
Galtan's Law, 21
Gamma pasture, 120, 124
Gape worms, chicks, 426
Garget, udder, 61
Gathering eggs, 442
General-purpose poultry type, 362, 363
German, bees, 451
  coach horse, 178, 179
Gestation period, 132
  swine, 246, 247
  table, 133
Gilts, breeding age, 246
  care, 245
Glassware, cleaning, 70
Goat associations, 465
Grade dairy cattle, 18, 19
Grades, sheep market, 346
Grading eggs, 442, 443
Grain, beef cattle, 119
  breeding swine, 245
  calf, 33, 34
  chicks, 418, 419
  feeding, colts, 200
    hens, 382
Grain mixtures, 46, 47
Grain scratch feed, 382
Grains lack minerals, 262
Green feed, chicks, 421
    hens, 388
Grooming, horse, 206
Growing, colts, 200–202
  lambs, 327–332
Grubs, sheep head, 337
Guernsey, breed, 9, 10
  butter-fat, 9
  characteristics, 10
  importations, 10
  milk, 9
  records, 9
Gutter, barn, 75, 76

H

Hackney, horse, 179
  pony, 181, 182
Hair, clipping, 90
  removal, swine, 273
Halter, colt breaking, 201
Hampshire, at fair, 268
  sheep, 290, 291
  swine, 225, 233, 234
Handling hogs, market, 271
Harness, care, horse, 208, 209
  colt, 201
Hatchery, accredited, 408, 409
Hatching, vs. buying chicks, 407, 408
  completion, 412
  eggs, 357, 409
  hens, 407
  moisture, 412
  temperature, 411
  time, 409
  ventilation, 411
Hauling distance, feed, 101
Hay, beef, cattle, 120, 123
Head grubs, sheep, 337
Health, colt, 199
  dairy, 20
  horse, 210–214
  swine pasture, 256
Heaves, horse, 191

Heifer, breeding, 40
Heifers, beef, 112
Height, horse, 193
Hen, efficiency, 382
  houses, 391–399
  internal organs, 376
  non-layer causes, 376, 377
  vs. other livestock, 382
Hens, culling, 365–378
  egg record, 433
  green feed, 388
Herd, bull, dairy, 49
  book, dairy, 54
  care, dairy, 49–53
  improvement, 53–59
  management, 131–133
    swine, 244–248
  starting, swine, 238–244
Heredity, horse, 218, 220
Hereford cattle, 104–106, 132
Hints, dairy, 52
Hitches, horse, 212–214
Hive, examining, 455
  parts, 453
Hives, moving, 453
Hog cholera, 251
  feed, corn, 263, 264
  house, central, 229, 230
  lice, 252
  markets, 226
Hogging-off corn, 262
Hogs, see also swine
  with cattle, 225
    steers, 153, 154
Holding cream, 95
  sheep, 305, 306
Holstein breed, 12–14
  butter-fat, 14
  characteristics, 14
  importations, 14
  milk, 13, 14
  records, 14
Home-grown swine feeds, 264
Honey containers, 461
  chunk, 461
  comb, 460
  extracted, 461
  marketing, 460, 461
  prices, 461
  thieves, 459
Hoof-rot, 61
Horns, preventing, 36
Horse, alleys, 196
  American, Saddle, 179, 180
Horse and jack associations, 464
Horse and mule, accidents, 208
    ages, 191–193
    barns, 195–197
Horse and mule, breeding, 218
    breeds, 171–183
    bridle, 208
    bulletins, 165, 222
    care, 205–210
    collar, 208
    costs, 168, 169
    decline, 169
    diseases, 210–214
    driving, 210
    efficiency factors, 216
    enterprise, 165–222
    environment, 219
    examination, 193, 194
    feeding, 202–205
    feet care, 206, 207
    grooming, 206
    harness, 208, 209
    health, 210–214
    height, 193
    improvement, 218–220
    indigestion, 211
    jobs, 165
    judging, 183–194
    keeping busy, 216
    labor, distribution, 216
      needed, 215
      record, 217, 218
    legs and feet, 194, 195
    management, 205–210
    manure, 207
    market classes, 221
    marketing, 221, 222
    possibilities, 165–171
    references, 165, 222
    replacement, 168
    sales, 222
    salt, 205
    sanitation, 210
    selection, 183–194
    shipping, 222
    supply, 167
    survey, 169–171
    things to make, 222
    training, 200–202
    troubles, 211
    type, 166
    using, 215–218
    variation, 220
    vices, 191, 208
    water, 204
    weight, 193
Horse, barn construction, 196
    costs, 197
  Belgian, 173, 174
  blindness, 190
  Clydesdale, 175, 176
  coach, 177, 178

Horse, feed needs, 203
  five-gaited, 180
  Hackney, 179
  mangers, 197
  Morgan, 180, 181
  Percheron, 173
  points, 188
  pony breeds, 181, 182
  projects, 166
  rations, 204
  shire, 176, 177
  stalls, 196
  standard bred, 179
  thoroughbred, 177
  types, 172
  unsoundness, 189–191
House, brooders, 414–417
  essentials, hen
  individual, swine, 230
  laying, 391–399

I

Ice cream, cream for, 92
Impaction, rumen, 62
Improvement, herd, 53–59
  horse, 218–220
  mutton, 338
  selection, 219
  sheep, 337–339
  wool, 338
Incubation conditions, 410
  records, 433
Incubator, choice, 411
  preparing, 411
  running, 411
Incubators vs. hens, 407
Indigestion, horse, 211
Inflammation, udder, 61
Inspecting hives, 456
Intestinal worms, hens, 428
Inventory, cattle, 161
  dairy form, 56
  form, 161
Investment, swine, 224
Italian bees, 451

J

Jack, community, 220
Jersey breed, 11, 12
  butter fat, 12
  characteristics, 12
  importations, 12
  milk, 12
  records, 12
Job analysis, beef, 99
    beef cattle, 101
Job analysis, bees, 449
    dairy, 1
    horse and mule, 165
    poultry, 351
    sheep, 281
    swine, 223
Judging, beef cattle, 109–114
  birds, 437
  dairy cattle, 19–28
    score card, 22
  details, sheep, 306–310
  horse and mule, 183–194
  poultry, 435–440
  sheep, 302–313
  soundness, 189–191
  swine, 238–244
Judgment, comparative, 189
  developing, 187, 188
Junipers Venus, Belgian mare, 198

K

Karakul sheep, 302
Keeping records, cattle, 160–164
Kicking cows, 51
Killing, beef, 159
  hogs, 273
King, Robert, project, 358, 359
  ventilation, 77

L

Labor, bees, 450
  record form, 162
  sheep, 284
  swine, 224
Lamb, bowels, 326
  castrating, 330, 331
  creep, 315, 329
  digestion, 326
  disowned, 326
  docking, 330
  growing, 327–332
  marketing, 344
  number, 339
  nursing, 326
  orphan, 327
  owning, 326
  slaughtering, 350
Lambing, difficult, 325
  management, 324–327
  quarters, 325
  season, 325
Lambs, market, 328, 329
Lard, saving, 274
  type, 232
Lard-type, described, 241–243
  score card, 242, 243

Law, Galton's, 21
Layers, age factor, 377
Laying, flock, culling, 365–378
    feeding, 379–390
    house, 391–399
      cross-section, 393
  persistent, 366, 367
  ration, 382, 383
Lease, beef farm, 101
Leg weakness, 425
Leghorn, cock, 365
  pullets, 355, 359
Legs and feet, horse, 194, 195
Legume hay, dairy, 42, 43
Leicester sheep, 295
Lice, calf, 39
  cattle, 137
  hog, 252
  horse, 214
  poultry, 428
Light, barn, 78
  Brahma cods, 364
  factor, hens, 389, 390
  horse, breeds, 177–180
  score card, 186, 187
  type, 172
Lights, how to use, 390
  when to use, 390
Lime, ration, 45
Lincoln sheep, 296, 297
Litter, carrier, 78
  laying house, 396
Litters per year, 246
Live poultry, marketing, 447
Livestock, associations, 463–465
  market, 271
  numbers, 466
  prices, 466
  production, 466
Loading cattle, 155
Location, bees, 450
  horse barn, 196
  sheep shed, 315
Longevity, hens, 403
Long-wooled sheep, 295–297
Lumpy jaw, 63
Lung worm, sheep, 335

M

Maggot, sheep, 335
Major, dairying, 3
Making, butter, 93–95
  cheese, 96, 97
Male bird, 404
Management, baby beef, 140
  beef herds, 131–133
  calf, 35
Management, lambing, 324–327
  poultry, 405
  sow and litter, 252–255
  swine, 244–248
  work stock, 205–210
  young poultry, 413–426
Managing dairy details, 52
  herd, dairy, 49–53
  manure, 53
Mange, horse, 214
  swine, 252
Manger, barn, 75, 76
Mangers, horse, 197
Man o' War, stallion, 177
Manure, carrier, 78
  managing, 53
  poultry, 427
  removal, 89
  saving, horse, 207
Mare and foal, care, 198, 199
Mares, as work stock, 217
Margins, steers, 148–150
Market, classes, horse, 221
    sheep, 346
  eggs, 442, 443
  kinds, poultry, 445
  lambs, 328, 329
  livestock, 271
  preparation, horses, 222
  sheep, feeding, 323, 324
  swine, feeding, 260–264
Marketing, beef cattle, 154–158
  butter, 95
  cattle, time for, 157
  coöperative, 156
    swine, 271
  honey, 460, 461
  horses, 221, 222
  live poultry, 447
  poultry, 441–447
  sheep, 344–347
  swine, 269–271
  talk, 155
  wool, 345
Marking calves, 37
  cattle, 130
  swine, 277, 278
Masculinity, ram, 312
Mash, chick, 419, 420
  feeder, poultry, 396
  laying, 382, 383
  wet, 384
Mating breeding birds, 405
Meat, breed-types, poultry, 362
  ring, 158–160
Meats, curing, 274, 275
  smoking, 275
Measuring calf growth, 37, 38

Mediterranean class, 360–362, 365
Merino, rams, 298–300
  sheep types, 299, 300
Michigan laying house, 394
Milk, and grain scratch, 384
  Ayrshire, 8
  bottling, 90
  Brown Swiss, 15
  certified, 89
  chicks, 419–421
  composition, 85, 86
  cooler, 80, 81
  defined, 85
  disposal, 3, 4
    record, 55, 56
  Dutch belted, 15, 16
  fever, 60
  Guernsey, 9
  Holstein, 13, 14
  house, 80, 81
  iced, 91
  Jersey, 12
  pails, 89
  production, 85–92
  quality, 70, 71
  Red Polled, 16, 17
  sanitation, 86, 87
  selling, 85–92
  Shorthorn, 17
  substitutes, 37
  sugar, 86
  testing, 57, 58, 64–72
  utensils, 87
  variations, 70, 71
  vs. butter, 95
    sales, 92
  vs. cheese, 97
  vs. cream sales, 92
  weighing, 57
  wholesale, 90
Milking, clean, 51
  machines, 79
Minerals, egg-laying, 385
  milk, 86
  swine, 262
Minor, dairying, 3
Missouri Ann and eggs, 404
Mites, poultry, 428
Mixtures, grain, 46, 47
Moisture, hatching, 412
Molt, significance, 373–375
Morgan, horse, 180, 181
Morning, lighting, 390
Moths, bee, 459
Motorization, effects, 167
Moving hives, 453
Mule, classes, 221
  draft, 183
Mule, farm, 184
  hybrid, 182, 183
  projects, 167
  (see also horse), 165–222
  types, 182–184
Mutton, consumption, 282
  improving, 338
  sheep, score card, 310
  world production, 283

N

Needs, horse and mule, 165–171
Nests, poultry, 397
Nursing lambs first, 326
Nutrients, feeds, 467, 468
Nutritive ratio, swine, 262

O

Oats and middlings, swine, 245
    rye, swine, 264
Ohio check rules, 414
Orphan lamb, 327
Overrun, butter, 94
Owning other lambs, 326
Oxford sheep, 291, 292

P

Packing eggs, 443
  fleeces, 342
Pails, milk, 89
Palatability, ratio, 45
Parasites, horse, 213
  sheep, 332–337
  swine pasture, 256
Parts, swine, 239–241
Pasture, areas, 31
  beef, 120–127
  blue-grass, 259
  capacity, 123–127
  crops, dairy, 29
  fertilizing, 124
  health, swine, 256
  improving, 123–127
  land, beef, 101
  native, 125
  permanent, 123–127
  rape for swine, 259
  reasons, swine, 257
  reserve, 125
  shade, 127
  sheep, 283, 285
  succession, swine, 256
  summer, 124
  swine, 255–260
  table, swine, 259

Pasture, value, sheep, 316
  water, 125, 126, 319
Pastures, dairy, 28–31
  maintaining, 31
  sheep, 315–319
  supplementary, 31
Pedigree, dairy cattle, 21
Pelt removal, sheep, 349
Pelvis bones, 371–374
Pens, sheep, 315
Percheron horse, 173
Permanent sheep pasture, 317
Phosphorus ration, 45
Pig, creep, 245, 254, 255
  rail, 230
Plymouth Rock, cock, 365
  hen, 363
Pneumonia, calf, 38, 39
Points, dairy cow, 25–27
  fowls, 438, 439
  horse, 188
  unsoundness, 190
Poland China swine, 233–235
Poll evil, 190
Polo pony, 182
Pony, breeds, 181, 182
  polo, 182
Pork, costs, 224
  curing, 272–276
    barrels, 274
  demand, 224
Portable, brooder house, 415–417
  swine house, 228–230
Possibilities, dairy, 1
Post-mortem cholera, 251
  hen, 376–429
Poultry, accredited, 402, 409
  analysis, 351
  breathing, 392
  breeding, 399–406
  breeds, 360–365
  bulletins, 351, 447
  business, starting, 357, 358, 360
  care, young, 413–420
  cholera, 429
  classification, 361
  culling, 365–378
  diseases, 424–430
  distribution, 354, 355
  dressing, 446
  egg type, 360–362
  enemies, 424–430
  enterprise, 351–447
  exhibiting, 435–440
  experiments, 352, 353
  fattening, 446
  feeding, layers, 379–390
  general type, 362, 363
Poultry, green feeds, 421
  house, back-yard, 356
    building, 397, 398
    care, 399, 427
    interior, 381
    lighting, 389, 390
    location, 393, 394
    project, 415
    remodeled, 399
  houses, 391–399
  industry type, 356
  jobs, 351
  judging, 435–440
  lice, 428
  manure, 427
  market kinds, 445
  meat breed, types, 362
    type, 362
  mules, 428
  points contrasted, 438, 439
  possibilities, 351–360
  problems, 353
  production map, 354
  products, marketing, 441–447
  project, 355, 356, 358, 359, 395, 397, 421–423
  protein, 421
    for, 385
  qualities, 400
  rapid breathing, 392
  record showings, 434
  records, 430–434
  references, 351–447
  sanitation, 426, 427
  science, recent, 352
  soup, 428
  things to make, 447
  tuberculosis, 429
  ventilation, 393
  worms, 428
  yards, 399
Preparation, fair, 144
  swine shipment, 271
Preparing, sheep fairs, 343
  show birds, 436, 437
Prepotency, dairy, 7
Preserving eggs, 441
Prevent swarming, 457
Price, beef cattle, 112
Prices, butter, 95
  eggs, 445
  feed for eggs, 391
  honey, 461
  livestock, 466
  sheep products, 284
  steer, 149, 150, 157, 158
  swine, 270
Prime grade sheep, 347

Problems, poultry, 353
  (see each job)
Producing milk, 85–92
Production, egg, 399–406
    standards, 368
  map, poultry, 354
  records, cows, 57
Profit from milk, 4
Profits, lighting, 389, 390
Project, baby beef, 139
  beef-calf, 111
  chicks, 414, 421–423
  horse, 166
  swine, 261, 262
Projects, mule, 167
  poultry, 355, 356, 358, 359, 395, 397, 421–423
  sheep, 284, 285, 317
  swine, 225, 233–236, 239, 245, 258 265–270
Protein, animal, hens, 385
  concentrates, 128
  cost, 46
  for cows, 44
  poultry, 421
Public sales, cattle, 144
Pullet eggs, hatching, 401
Pullets, culling, 378
  gains, 420, 423
  green feed, 421
  numbers, 422
  range, 422
  separation, 422
  size, 423
  summer care, 422
Pure-bred, swine selling, 269
  vs. grade swine, 238
Pure-bred vs. grade cattle, 18, 19

Q

Queen bee, 455
  rearing, 461

R

Races, bees, 451
Racks, sheep, 314
    feeding, 323
Railroads, beef shipping, 101
Raising colts, 197–200
Ram, conditioning, 320
Rambouillet, ram, 338
  sheep, 301, 302
Range, lambs, 324
  pullets, 422
Rape, pasture, swine, 259
  sheep pasture, 317
Ration, balanced, 44
  bulk, 45
  constipating, 45
  ewes, 322
  fattening birds, 446
  full-feed swine, 261, 262
  laxative, 45
  laying, 382, 383
  lime in, 45
  palatability, 45
  phosphates in, 45
Rations, balancing, 44–48
  calculating, 44–48
  calf, 33, 34
  cattle fattening, 153
  chicks, 418–420
  ewe mothers, 328
  horse, 204
  sample, 46, 47
  swine, 254, 262–264
  winter cattle, 146, 147
Receipts, record form, 163
Record, brooder, 433
  form flock, 432
  forms, 161–164
  incubation, 433
  keeping, cattle, 160–164
    horse, 217, 218
  Red Polled, 17
  trap-nest, 369
Records, analysis, 433, 434
  Ayrshire, 9
  breeding, 55
  Brown Swiss, 15
  calf birth, 55
  calf feed, 54
  credits, 56
  dairy, 53–56
    sales, 56
  Dutch Belted, 16
  egg, 431, 432
  expense, 54
  feed, 54
    received, 55
  flock, 431, 432
  Guernsey, 9
  Holstein, 14
  inventory, 56
  Jersey, 12
  labor, 54
  milk disposal, 55, 56
  poultry, 430–434
    flock, 402
  production, cows, 57
  receipts, 55
  sheep, 337, 339
  Shorthorn, 17

Records, summary, 55, 163
  swine, 276–279
Red Polled breed, 16
  butter-fat, 17
  cattle, 107, 108
  characteristics, 16
  milk, 16, 17
  record, 17
References, bee, 449
  livestock books, 463
  poultry, 351, 447
  sheep, 281
  swine, 223, 279
Registering calves, 37
  pigs, 278
Registration, age, 130
  beef cattle, 129, 130
  rules, 129, 130
Registry of merit, 58
Replacement, horse and mule, 168
Requeening, 457
Retail vs. wholesale milk, 92
Rhode Island Red hen, 363
Ring bone, horse, 190
Ringworm, calf, 39
Robber bees, 459
Romney sheep, 297
Roosts, poultry house, 396, 397
Rotations, beef farm, 121, 122
  dairy, 28–31
  sheep, 318
Roughage, cattle, 120, 123
  feeding, 42
  horse feed, 203
Round worms, swine, 249
Roup, poultry, 428
Rules, breeding flock, 401–403
  chicks, 414
  egg contest, 401–403
  registration, 129, 130
Rumens, impaction, 62
Rye, swine pasture, 260

S

Saddle of harness, 209
Sale, catalogs, 144
  horse, 222
  preparation, 144
    swine, 266
Sales, dairy, records, 56
  of dairy stock, 84
  private dairy, 84
  public dairy, 84
Salt, ewes, 323
  horse, 205
  in ration, 45
Sampling milk, 70
Sanitary milk pails, 89
  score card, 88
Sanitation, horse, 210
  milk, 86, 87
  poultry, 426, 427
  scoring, 87, 88
  swine, 249
Sausage making, 275, 276
Saving harness, 209
Scales milk, 57
Score card, barn, 88
    bacon hog, 243, 244
    beef, 111
    dairy cattle, 22–24
    draft horse, 185, 186
    lard hog, 242, 243
    learning, 189
    light horse, 186, 187
    sheep, 309, 310
    using, 28
Scoring sanitation, 87, 88
Scours, calf, 38
Scratch grain and milk, 384
    chicks, 418, 419
Scrub elimination, 113
Selection, hen, 399–406
  horse, 219
    and mule, 183, 194
  importance, 184
  sheep, 302–313
  swine, 238–244
Selecting, cattle, 109–114
  dairy cattle, 17–27
    cows, 56, 57
  hogs to kill, 272
Self-feeder, cattle, 117
  poultry, 397
  swine, 227, 253, 264
Selling, breeding sheep, 342, 343
    swine, 264–269
  butter, 95
  cattle, 82–84
    time for, 157
  coöperative, 345, 346
  cream, 91
  cull hens, 377
  early lambs, 344, 345
  methods compared, 92
  milk, 85–92
    methods, 4
  show cattle, 141–144
  surplus cattle, 82
  wholesale milk, 90
Separator, adjustments, 72
  cream, 72, 81, 94
  speed, 72
  workings, 72
See names, sheep, 304

Shade, pasture, 127
  sheep pasture, 319
Sheared sheep, care, 341
Shearing, described, 341
  equipment, 341
  sheep, 340–342
Shed, cattle, 116, 146
Shed-roof house, 394
Sheep, advertising, 343
  age, 308
  associations, 465
  barns, 314, 315
  breeds, 286–302
  bulletins, 281
  butchering, 347, 350
  buying, 303
  carcass care, 349
  care of sheared, 341
  Carriedale, 294
  Cheviot, 294
  community interest, 283
  crops, 284
  Cotswold, 295, 296
  Delaine, 299–301
  disease danger, 283
  diseases, 332–337
  dog menace, 283
  Dorset Horn, 292, 293
  drenching, 334–336
  enemies, 332–337
  enterprise, 281–350
  equipment, 284, 313–315
  form flocks, 283
  fattening, 323, 324
  feeding, 318–324
  fences, 315
  fine wool, 298, 302
  foot trouble, 337
  fur bearing, 302
  growing young, 327–332
  grubs, 337
  Hampshire, 290, 291
  improving, 337–339
  jobs, 281
  judging, 302–313
  Karakul, 302
  labor, 284
  lambing, 324–327
  Leicester, 295
  Lincoln, 296, 297
  Long-wool breeds, 295–297
  maggot, 335
  market classes, 346
  marketing, 344–347
  marking, 339
  medium wool, 287–294
  Merino, 298–302
  Oxford, 291, 292
Sheep, pastures, 284, 285, 315–319
  possibilities, 281–285
  prices of products, 284
  projects, 284, 285, 317
  Rambouillet, 301, 302
  references, 281
  Romney, 297
  rotations, 318
  score card, 309, 310
  selecting, 302–313
  selling, showing, 342, 343
  sex and age names, 304
  shearing, 340–342
  shelters, 313–315
  Shropshire, 288, 289
  slaughter, 348
  Southdown, 287, 288
  Suffolk, 292
  things to make, 314
  Tunis, 294, 295
  types, 286–302, 304
  uses, 282
Shelter, calf, 39
  cattle, 114–118
Shelters, sheep, 313–315
Shetland pony, 181, 182
Shipping, cattle, 155
  hogs, 270, 271
  horse, 222
  time, cattle, 155, 156
Shire, horse, 176, 177
Shorthorn, butter-fat, 17
  dairy, 17
  milk, 17
  milking, 5
  pasturing, 125
  records, 17
Shorthorns, 102–104, 110
Show, preparation, swine, 266
Showing beet cattle, 141–144
  breeding sheep, 342, 343
  cattle, 82–84
  poultry, 435–440
  swine, 264–269
Shows, poultry, 435
Shropshire lambs, 285
  sheep, 288, 289
Side bones, horse, 191
Silage, dairy feed, 82
  making, 43
  summer, 41
Silo, beef cattle, 117, 147
  distribution, 118
  kinds, 117, 118
  location, 81, 82
Simultaneous treatment, 251
Sink, dairy house, 81

Sire, community, 59, 220
  conformation, 21, 22
  dairy, 21
Size poultry house, 395
Skim-milk, testing, 68
  vs. whey, 97
Skinning beef, 160
  sheep, 349
Slaughter, sheep, 348
  steers, 149, 150
Smith, sisters, 266, 267
  W. H. (swine), 223
Smoking meats, 275
Soiling crops, 41
Sorghums, beef cattle, 119
  grain, 119
Soundness, dairy cattle, 20
  horse, 189–191
Southdown sheep, 287, 288
Sow and litter, alfalfa, 258
    management, 252–255
Sows, culling, 248
  handling, 247
Soybeans pasture, swine, 260
  swine, 264
Spavin, horse, 191
Splints, horse, 190
Spotted Poland China, 234, 235
Stability, dairy, 2
Stallion, community, 219, 220
Stalls, barn, 78
  calf, 36
  horse, barn, 196
Stanchion, barn, 75, 76
Stanchions, calf, 35, 36
Standardbred horse, 179
Steenbock discovery, 387, 388
Steer, feeding, 151, 154
  grades and prices, 158
  prices, 149, 150, 157, 158
  type, 150, 151
Steers, buying, 147–151
  feeder, 147–151
  finding, 148
  heavy, 154
  margins, 148–150
  marketing, 154–158
  slaughter, 149, 150
  time to buy, 150, 151
Sticking, knife, 273
  sheep, 348
Stomach worm, sheep, 333
Stone, brooder, 416
Storing eggs, 443
  fleeces, 342
Strangles, horse, 211
Straw-loft house, 395
String halt, 191
Studying egg type, 437
Substitutes (milk), 37
Succulence, horse feed, 204
Suffolk, sheep, 292
Summary, record, 55, 163
Summer dairy feeding, 41, 42
Sunlight, effects, 353
  hen house, 396
  trial chicks, 386, 387
Survey, horse and mule, 169–171
Swarm prevention, 457
Swarming, 457
Sweet clover, swine, 257
Sweet-pickle pork, 275
Swine, adaptations, 225
  advertising, 269
  associations, 269
  auctions, 269
  Berkshire, 236
  books, 279
  breeding, 246–248
  breeds, 231–237
  bulletins, 223, 279
  butchering, 272–276
  buying, 239
  care, 244–248
  castration, 255
  Chester White, 235
  condition, 242
  crops for, 256
  culling, 247, 248
  death rate, 249
  demand, 224
  diseases, 248–252
  distribution, 224
  Duroc-Jersey, 232, 233
  ear markings, 277, 278
  enemies, 248–252
  enterprise, 223–279
  equipment, 227–231, 245, 254, 255
  feeding, 244–248, 260–264
    times, 264
  forage, 256
    table, 259
  form, 241
  gestation period, 246, 247
  Hampshire, 225, 233, 234
  handling in market, 271
  herd starting, 238–244
  houses, 228-231
  jobs, 223
  judging, 238, 244
  killing, 273
  labor and capital, 224
  lice, 252
  mange, 252
  market handling, 272
  marketing, 269–271

Swine, markets, 226
  minerals, 262
  pasture, 255–260
  points named, 239–241
  Poland China, 233–235
  possibilities, 223–227
  preparation, shipping, 271
  prices, 260, 270
  projects, 225, 233–236, 239, 245, 258, 261, 262, 265–270
  pure vs. grade, 238
  quality, 241
  receipts, 260
  records, 276–279
  references, 223, 279
  registering, 278
  sanitation, 249, 250
  selecting, 238–244
  self-feeder, 227, 253, 264
  shipments, 270, 271
  showing, 264–269
  Spotted Poland China, 234, 235
  Tamworth, 237
  terms defined, 240, 241
  types, 232, 236
  vitamines, 263
  vs. corn price, 225, 226
  weighing gains, 265
  with cattle, 153, 154
  worms, 249
  Yorkshire, 236, 237

T

Tamworth, swine, 237
Tank, water, 117
Tape worm, sheep, 335
Teats, chapped, 62, 63
Terminal market, 271
Tester, Babcock, 81
Testing, butter-fat, 64–72
  eggs, 412, 413
  glassware, 64
  milk, 57, 58, 64–72
  samples, 66
Tests, reading butter-fat, 67, 68
Texas, fever, 136
Thieves, honey, 459
Thoroughbred horse, 177
Thoroughpin, 191
Throwing corns, 63
Time, colt foaling, 198
Timing swine feeding, 260
Timothy, sheep pasture, 316
Tools, barn, 79, 80
Ton litter, 225
  feeding, 261
Ton litters, 270
Tractor influence, 218
Training, horse, 200–202
  rig, colt, 201
Transfers, beef cattle, 130
Trap-nested flock, 401
  nesting, 369
Troubles, horse, 211
Troughs, sheep, 314
Tuberculosis, 60
  cattle, 136, 137
  poultry, 429
Tunis sheep, 294, 295
Type, and function, horse, 172
  baby beef, 140
  beef, 102
  dairy, 18, 20, 59
  draft horse, 172
  horse and mule, 166
  light-horse, 172
  of house, swine, 228–231
  poultry, 360–365
  sheep, suitability, 313
  shelter, 115
  steer, 150, 151
  swine, 232, 236
Types, barns, 74
  hen house, 394
  Merino sheep, 299, 300
  of dairying, 3
  records, 163
  sheep, 286–302, 304

U

Udder troubles, 61
Udders, clipping, 90
Ultra-violet rays, 384, 388
Uniting bees, 456
Unsoundness, horse, 189–191
Uses, sheep, 282
  Wool, 282
Utensils, milk, 87
Utility fowl judging, 437, 438

V

Value, dairy cattle, 20
  sheep pasture, 316
Values, livestock, 466
Variation, horse, 220
Variations, cream, 72
  milk, 70, 71
Variety, poultry, 361
Vent, laying hen, 370, 372
Ventilation, barn, 77
  poultry, 393
Vices, horse, 191, 208

Vigor, breeding sheep, 313
  hens, 404
Vitamine classes, 385, 386
Vitamines, effects, 353
  egg-laying, 385
  milk, 86
  swine, 263

W

Walls, barn, 76
Warbles, cattle, 137
Warts, cattle, 63
Wash, tank, 81
Water, cattle, 48
  ewes, 323
  horse, 204
  in barn, 78
  layers, 388
  pasture, 125, 126
  sheep pasture, 319
  stand, poultry, 398
  tank, 117
  winter, cattle, 147
Watering, poultry, 397, 398
Weaning, beef cattle, 141
  colt, 199, 200
  pigs, 255
Weeds, pasture, 124
Weighing, milk, 57
  pullets, 423
  swine gains, 265
Weight, horse, 193
  market sheep, 347
Weights, beef cattle, 147
  calf, 38
Welsh pony, 181, 182
Wermelskirchen, Louis, 99
Western sheep, feeding, 323, 324
Wet mash, hens, 384
Wether, score card, 310
Whey, testing, 68
  vs. skim-milk, 97
White diarrhœa, 424
  Leghorn, hen, 405
  scours, calf, 38
Whirling test bottles, 67
Wing, clipping, 458
  molt, 374, 375
Winter, egg production, 352
  exercise, cattle, 146
  feeding, dairy, 42–48
  rations, 146, 147
  watering, cattle, 147
Wintering cattle, 145–147
  feed, 145
Wool crop, 342
  improving, 338
  marketing, 344–347
  medium, breeds, 287–294
  use, 282
  world production, 283
Work horses, judging, 185
  stock, using, 215–218
Worker, bee, 452
Worm-dosing device, 336
  sheep screen, 335
Worms, horse, 214
  nodular, 334
  poultry, 428
  sheep, 333–336
    lung, 335
    tape, 335
  swine, 249
Wyandotte pair, 364

Y

Yards, disinfecting, 427
  poultry, 399
Yorkshire swine, 236, 237
Young dairy stock, 31–40
  care, 39, 40
  horse training, 200–202